High accuracy measurement of non-CO_2 GHGs and application in China

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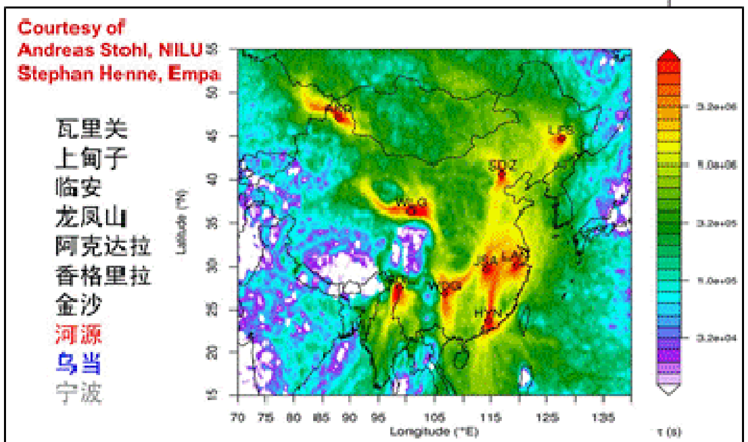
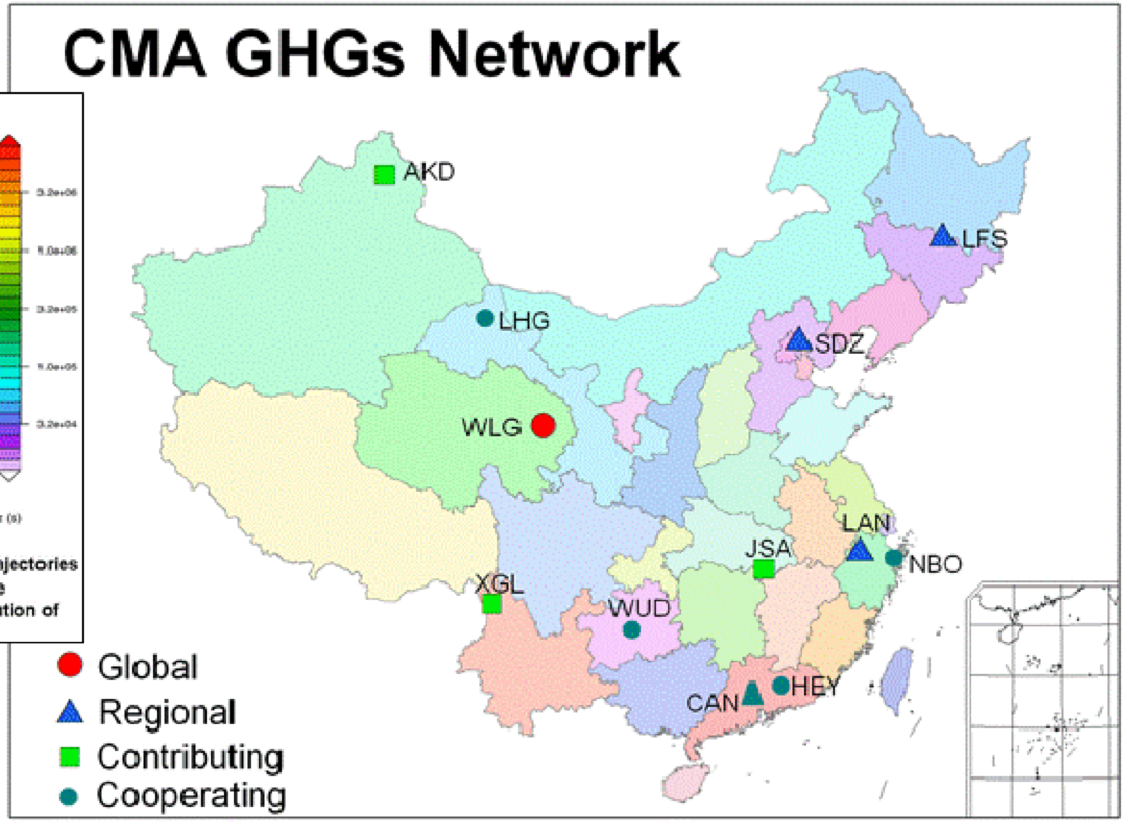
InGOS International Conference, 21-24 Sept. 2015
Utrecht, The Netherlands

In cooperation with international groups

In-situ and/or discrete high accuracy measurements of ambient GHGs by <u>custom-designed systems</u> have been added at the five background stations (WLG, SDZ, LAN, LFS, XGL)



2010年9站足印函数 Annual total PBL residence time for back-trajectories started at CAMS sites at station altitude. Trajectory calculations were performed with FLEXTRA based on ECMWF wind fields with a resolution of 0.2° x 0.2° over China and 1° x 1° for the rest of the globe.

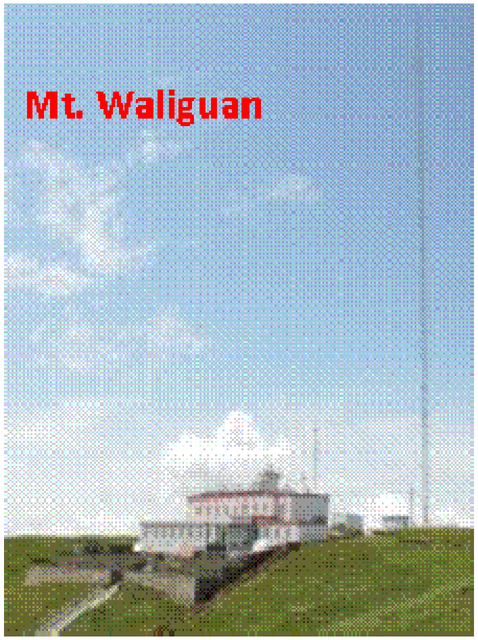


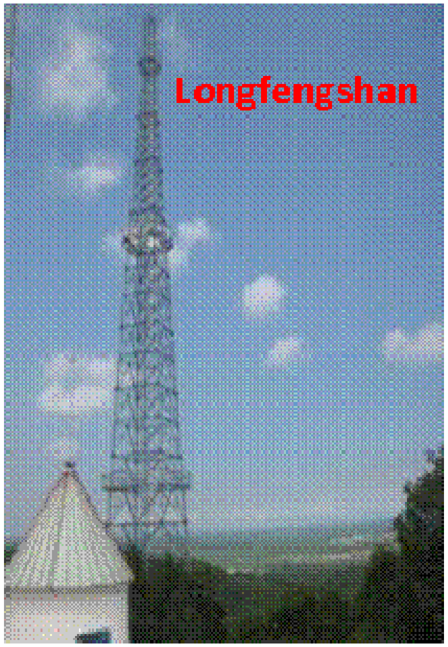
WMO/IAEA Recommended compatibility of

Table 1- Recommended compatibility of measurements within the scope of GGMT

Component	Compatibility goal	Extended compatibility goal	Range in unpolluted troposphere	Range covered by the WMO scale
CO_2	± 0.1 ppm (Northern hemisphere) ± 0.05 ppm (South. hemisphere)	± 0.2 ppm	360 - 450 ppm	250 – 520 ppm
CH_4	± 2 ppb	± 5 ppb	1700 – 2100 ppb	300 – 2600 ppb
CO	± 2 ppb	± 5 ppb	30 – 300 ppb	20 -500 ppb
N_2O	± 0.1 ppb	± 0.3 ppb	320 – 335 ppb	260 – 370 ppb
SF_6	± 0.02 ppt	± 0.05 ppt	6 – 10 ppt	1.1 – 9.8 ppt
H_2	± 2 ppb	± 5 ppb	450 – 600 ppb	140 –1200 ppb
$\delta^{13}C$-CO_2	± 0.01‰	± 0.1‰	-7.5 to -9‰ vs. VPDB	
$\delta^{18}O$-CO_2	± 0.05‰	± 0.1‰	-2 to +2‰ vs. VPDB	
$\Delta^{14}C$-CO_2	± 0.5‰	± 3‰	0-70‰	
$\Delta^{14}C$-CH_4	± 0.5‰		50-350‰	
$\Delta^{14}C$-CO	± 2 molecules cm^{-3}		0-25 molecules cm^{-3}	
$\delta^{13}C$-CH_4	± 0.02‰	± 0.2‰		
δD-CH_4	± 1‰	± 5‰		
O_2/N_2	± 2 per meg	± 10 per meg	-250 to -800 per meg (vs. SIO scale)	

GAW Report No. 213, July 2014





Picarro G1301/1302

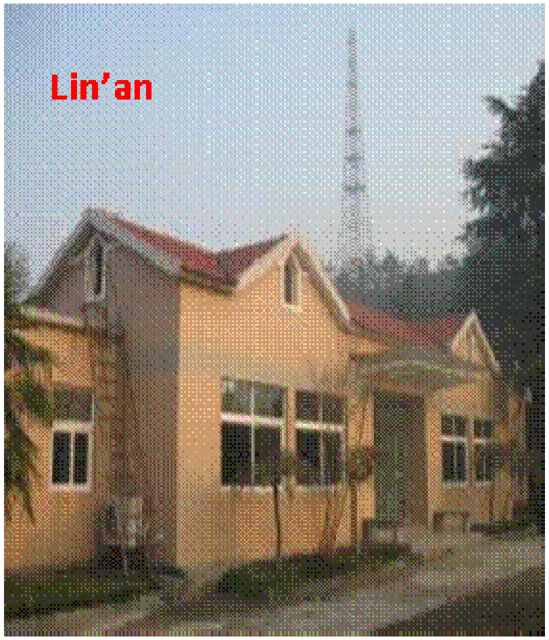
Agilent 7890 GC- FID+ECD

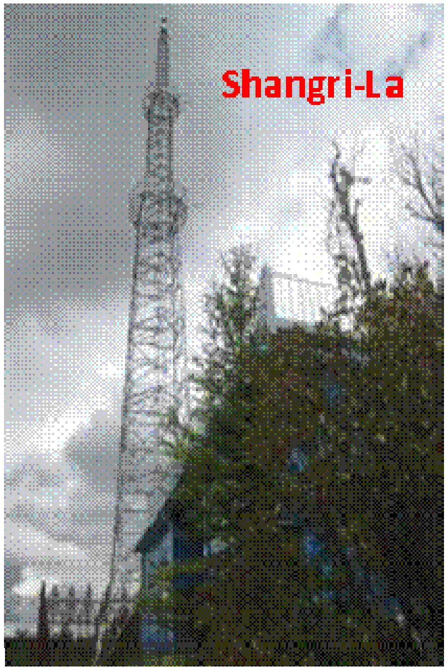
M60/70 + flask (NOAA type)

Canister (halocarbon)

Agilent 6890 GC- ECDs (Halocarbon)

Medusa GC (Halocarbon)





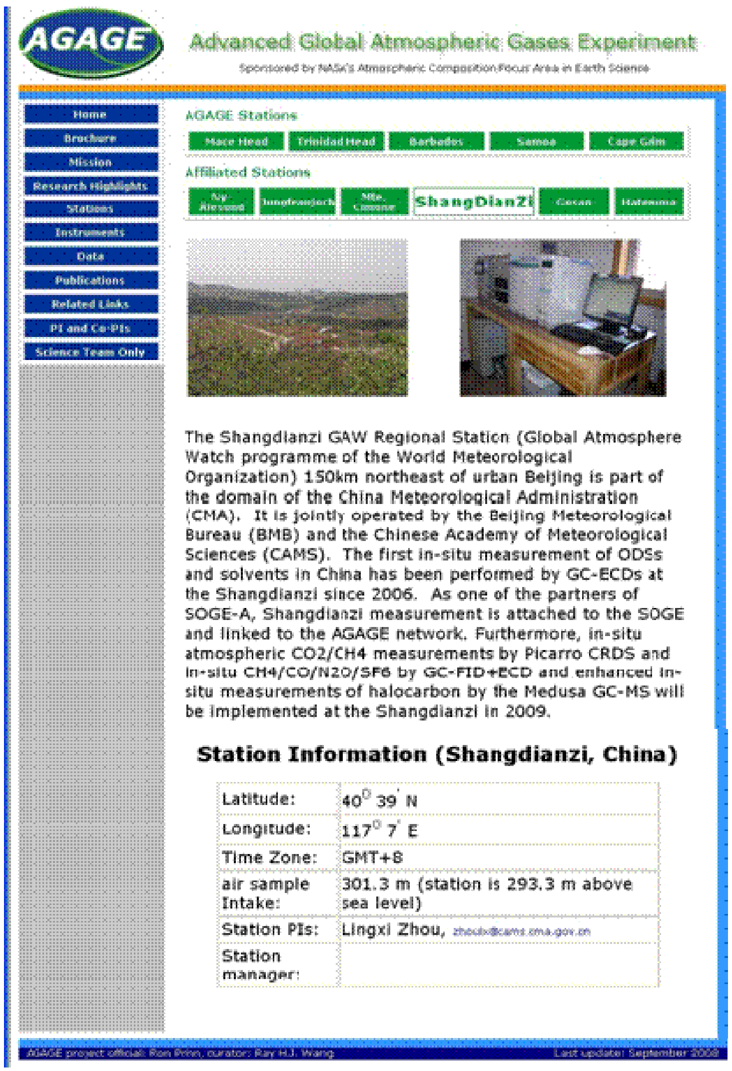
CAMS Lab in Beijing (GHGs & tracers)

December 2009

March 2013

CMA GHGs Lab

Joint AGAGE, SOGE and affiliated Networks



AGAGE

Advanced Global Atmospheric Gases Experiment

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

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AGAGE Stations

Mace Head | Trinidad Head | Barbados | Samoa | Cape Grim

Affiliated Stations

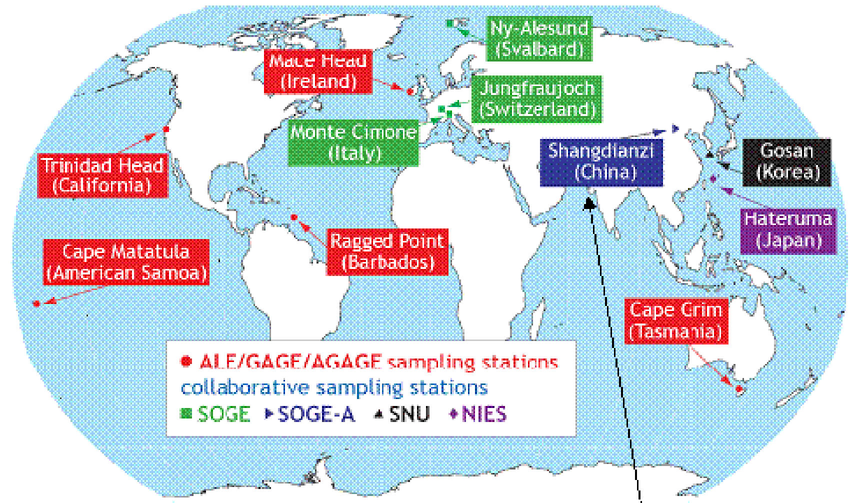
Ny Alesund | Jungfraujoch | Mte. Cimone | ShangDianZi | Gosan | Hateruma

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.

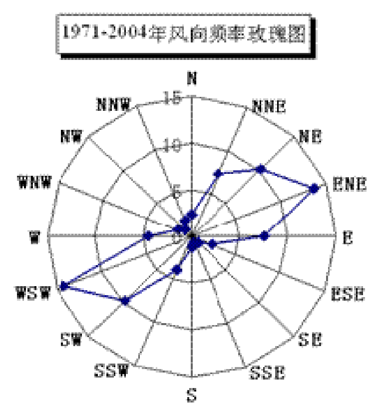
Station Information (Shangdianzi, China)

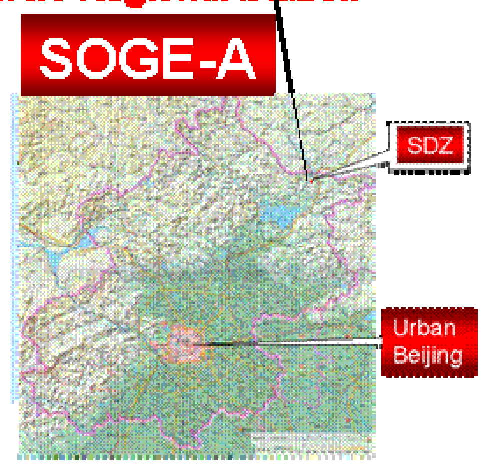
Latitude:	40° 39' N
Longitude:	117° 7' E
Time Zone:	GMT+8
air sample Intake:	301.3 m (station is 293.3 m above sea level)
Station PIs:	Lingxi Zhou, zhoulx@cams.cma.gov.cn
Station manager:	

AGAGE project official: Ron Prinn, curator: Ray H.J. Wang — Last update: September 2008



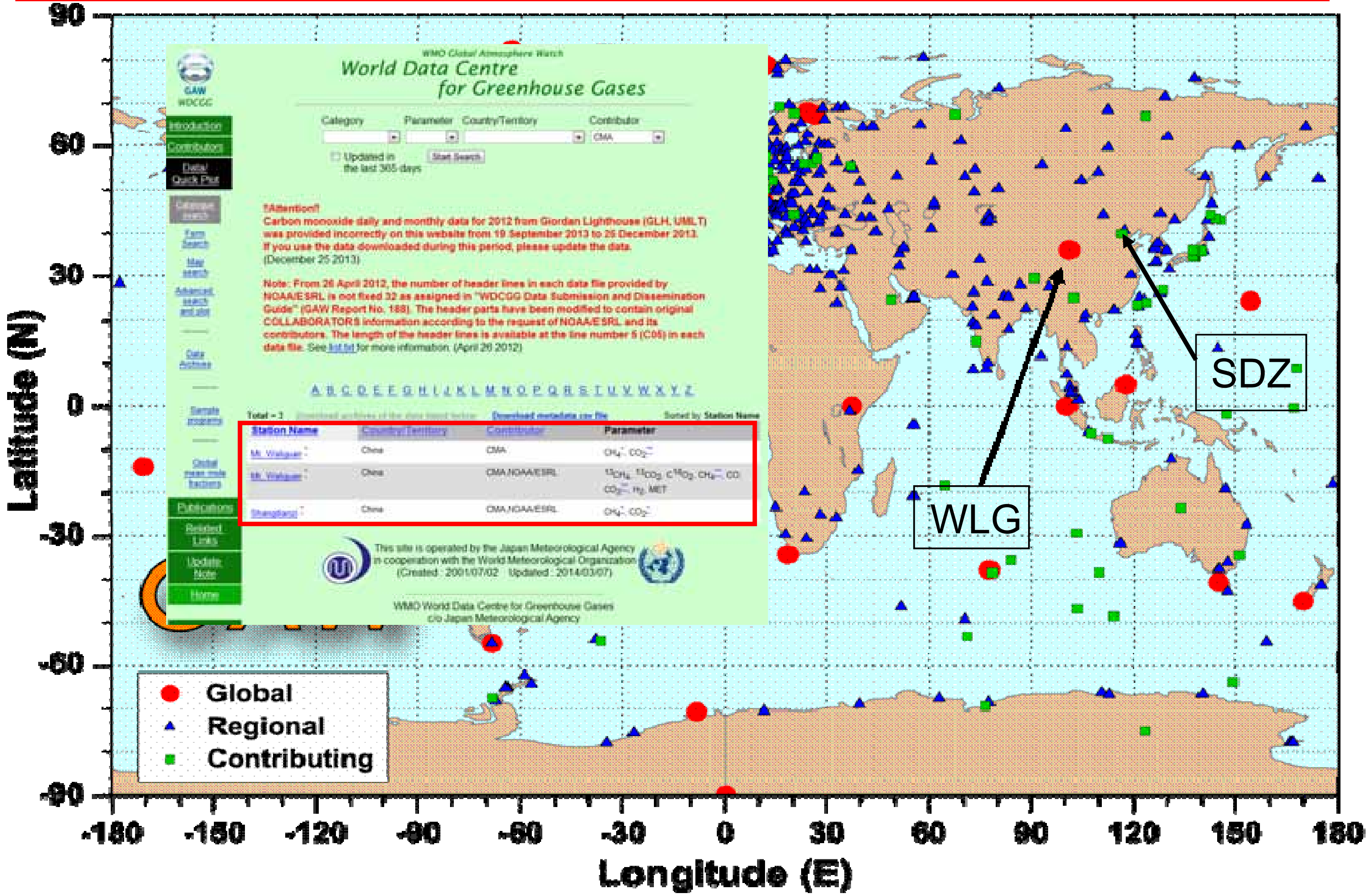
Wind Rose (1971-2004)
Shangdianzi GAW Regional Station



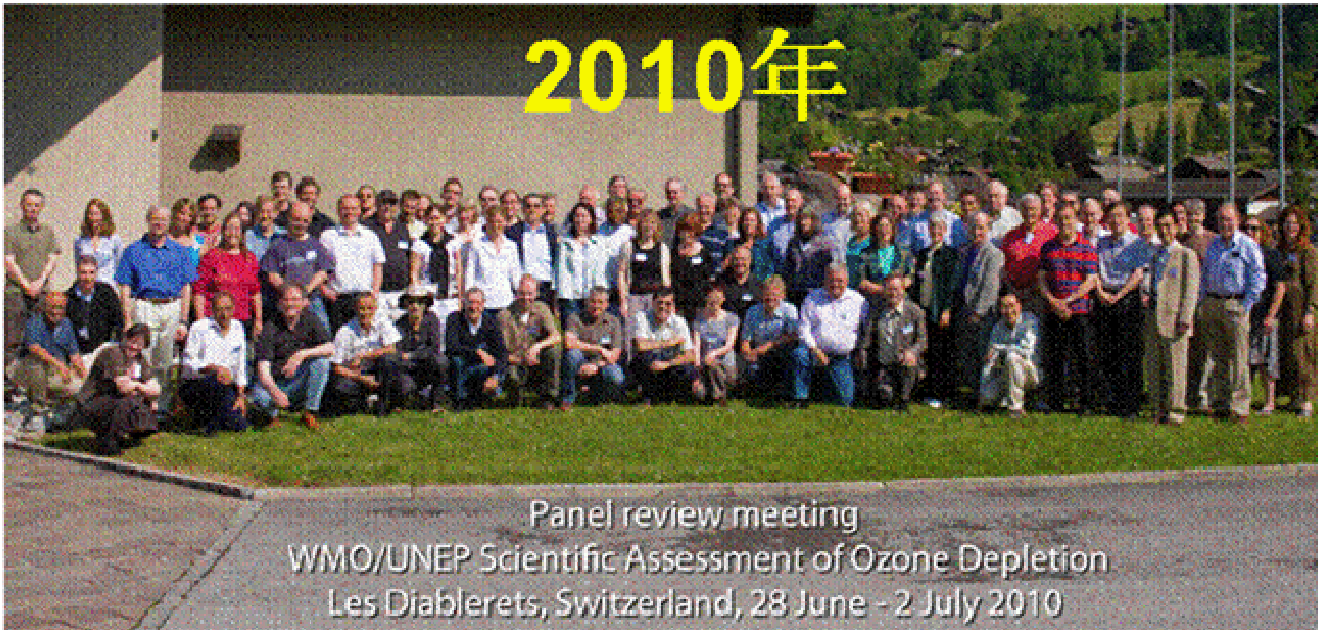


>30% from clean sector
Ca 22% from Urban Beijing sector

The 20-year GHGs record contributes to the WDCGG, WMO's GHGs Bulletin, Global-View and Obspack data products, IPCC assessments, and other key products.



Panel Review Meeting
WMO/UNEP *Scientific Assessment of Ozone Depletion: 2010*



CMA represents the WMO' Commission for Atmospheric Sciences (CAS) in China and is deeply involved in the GAW.

WMO EC 65, 66, 67
(Geneva, 2013, 2014, 2015)

Quadrennial

GAW 2009 (Gneva, 5-7 May)

GAW 2005 (Gneva, 14-16 March)

17th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases, and Related Measurement Techniques (GGMT-2013)

10-14 June 2013 Beijing, China

WMO

GAW

中国气象局 CHINA METEOROLOGICAL ADMINISTRATION

AMS

17th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases, and Related Measurement Techniques (GGMT-2013)

10-14 June 2013 Beijing, China


SCRIPPS INSTITUTION OF OCEANOGRAPHY
UC San Diego
World Meteorological Organization
Weather • Climate • Water
GLOBAL ATMOSPHERE WATCH
18th WMO/IAEA Meeting on
Carbon Dioxide, Other Greenhouse Gases, and Related Measurement Techniques (GGMT)
September 13-17, 2015 • The Robert Paine Scripps Forum • La Jolla, CA

Preliminary outcome of the 6th WMO/IAEA Round Robin Comparison Experiment

WMO/IAEA Round Robin Referee: ***Lingxi Zhou**[1]
(zhoulx@cams.cma.gov.cn)

NOAA Coordinating Team: **Pieter Tans**[2], **Duane Kitzis**[2], **Ken Masarie**[2] (wmorr@noaa.gov)

1. CAMS, CMA, China
2. GMD, ESRL, NOAA, USA,

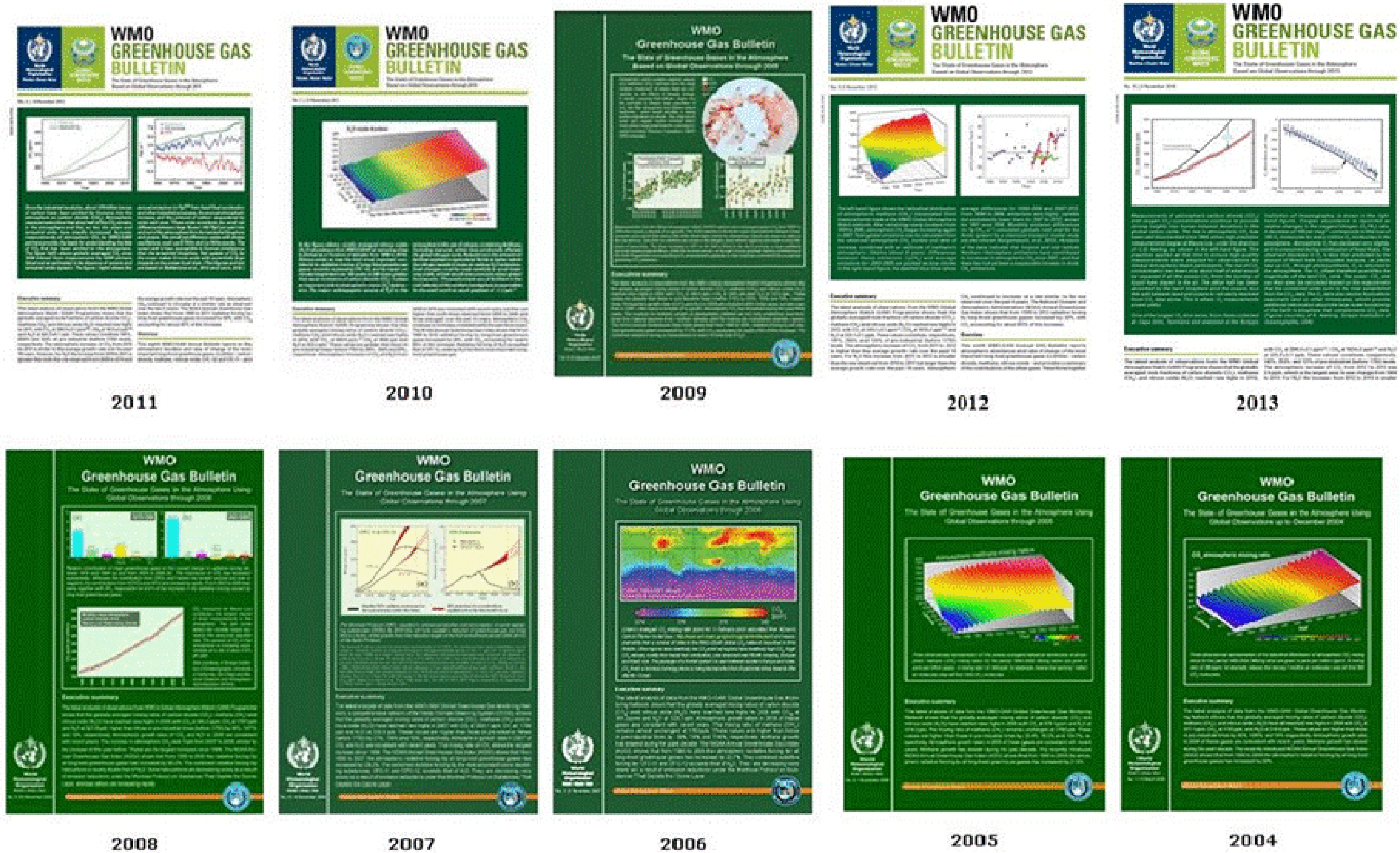
13-17 Sept. 2015, La Jolla

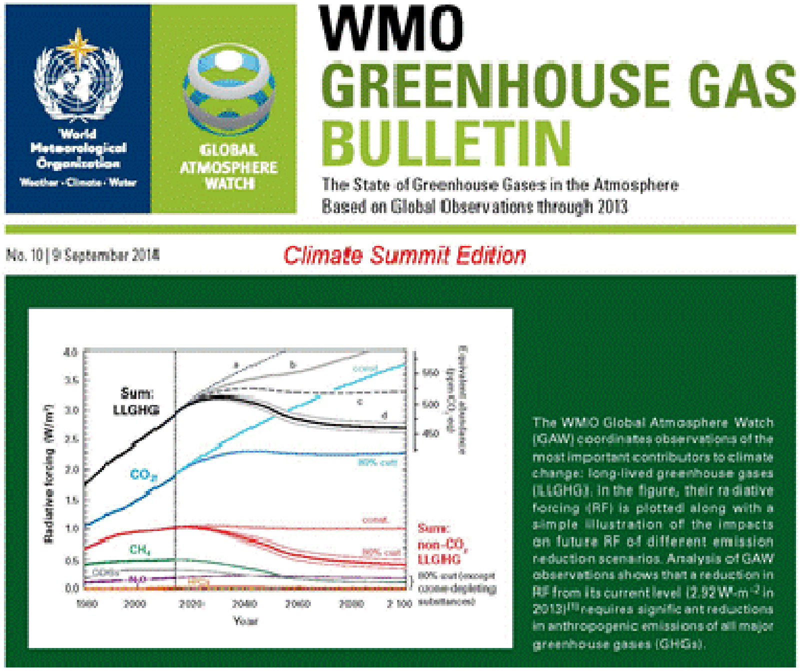
WMO

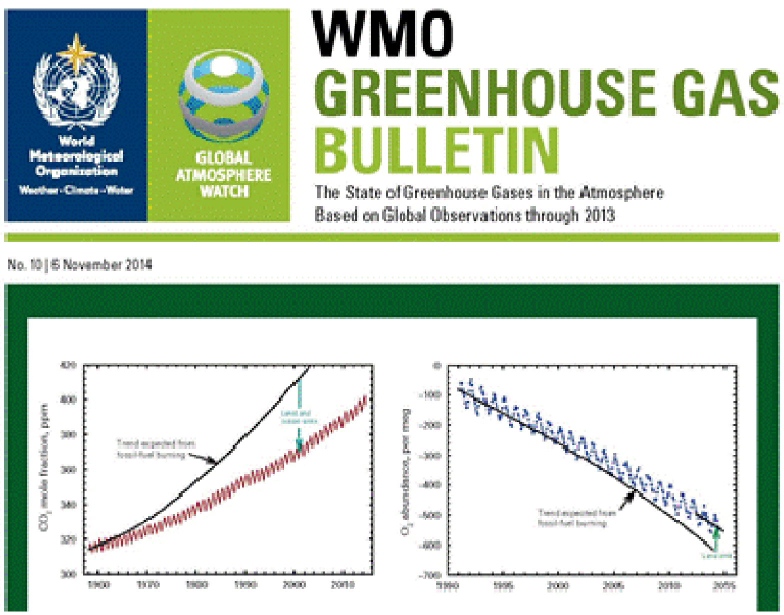
GAW

WMO GHG Bulletin

WMO Annual Greenhouse Gas Bulletins







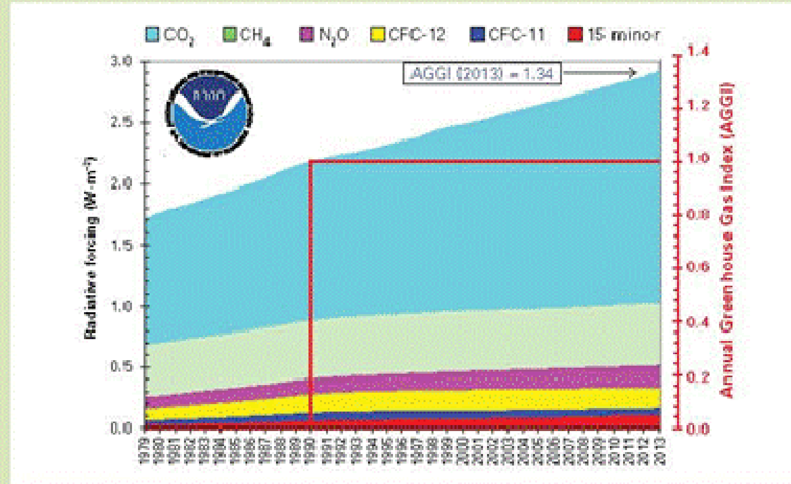


Figure 1. Atmospheric radiative forcing, relative to 1750, of LLGHGs and the 2013 update of the NOAA Annual Greenhouse Gas Index (AGGI)

Table 1. Global annual mean abundances (2013) and trends of key greenhouse gases from the WMO/GAW global greenhouse gas monitoring network. Units are dry-air mole fractions, and uncertainties are 68% confidence limits.

	CO_2	CH_4	N_2O
Global abundance in 2013[4]	396.0±0.1 ppm	1824±2 ppb	325.9±0.1 ppb
2013 abundance relative to year 1750[a]	142%	253%	121%
2012–2013 absolute increase	2.9 ppm	6 ppb	0.8 ppb
2012–2013 relative increase	0.74%	0.33%	0.25%
Mean annual absolute increase during last 10 years	2.07 ppm/yr	3.8 ppb/yr	0.82 ppb/yr

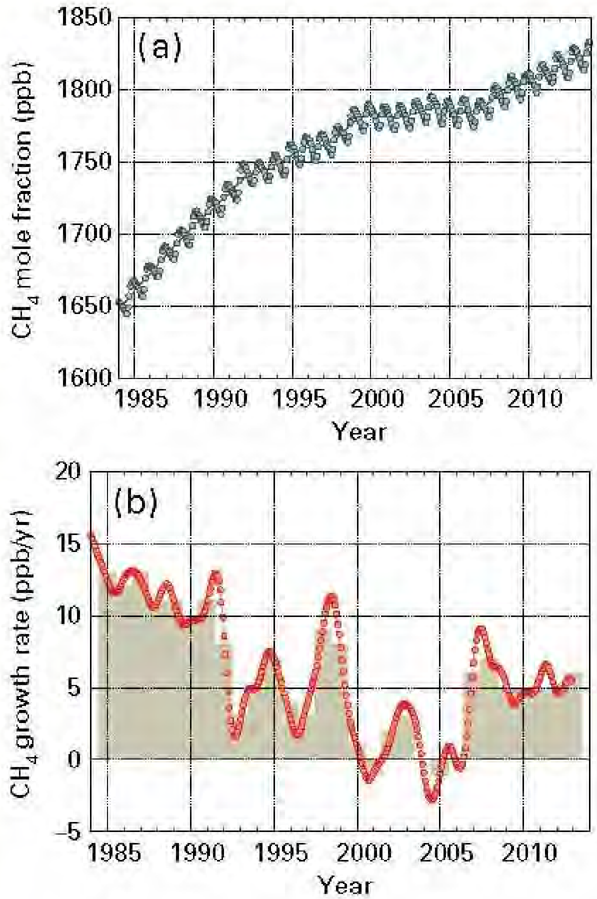


Figure 4. Globally averaged CH_4 mole fraction (a) and its growth rate (b) from 1984 to 2013. Differences in successive annual means are shown as shaded columns in (b).

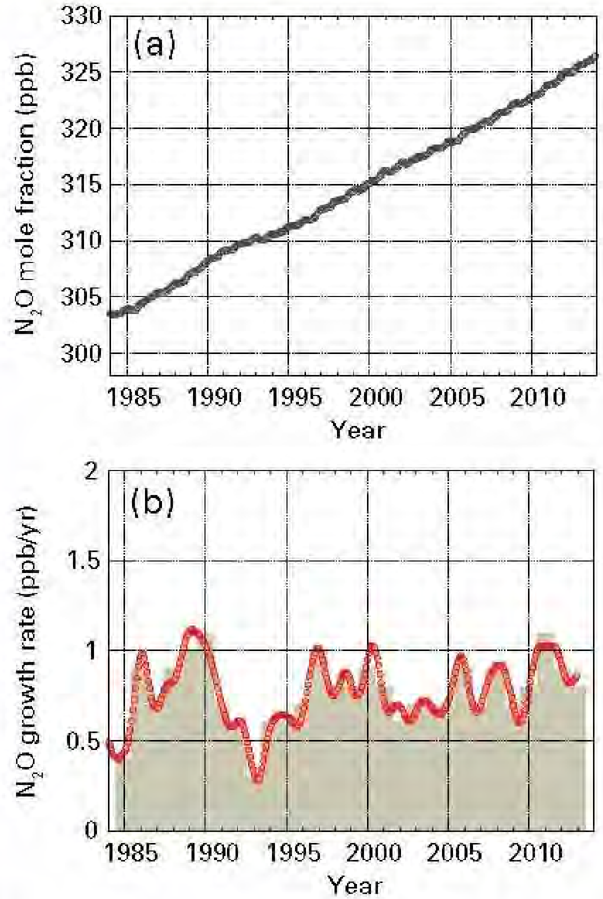


Figure 5. Globally averaged N_2O mole fraction (a) and its growth rate (b) from 1984 to 2013. Differences in successive annual means are shown as shaded columns in (b).

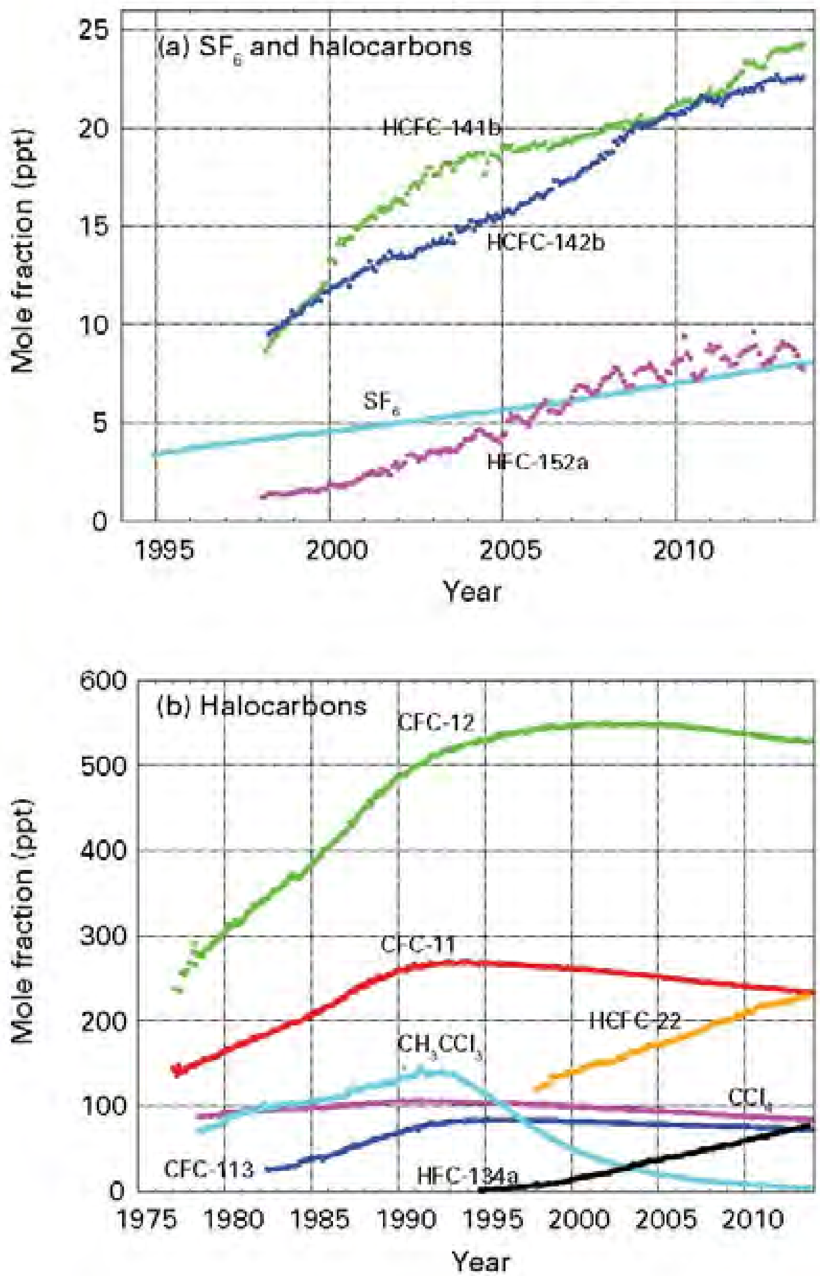


Figure 7. Monthly mean mole fractions of sulphur hexafluoride (SF_6) and a suite of halocompounds (SF_6 and minor halocarbons (a) and major halocarbons (b)). The numbers of stations used for the global analyses are as follows: SF_6 (23), CFC-11 (24), CFC-12 (25), CFC-113 (23), CCl_4 (21), CH_3CCl_3 (23), HCFC-141b (9), HCFC-142b (13), HCFC-22 (13), HFC-134a (9) and HFC-152a (8).

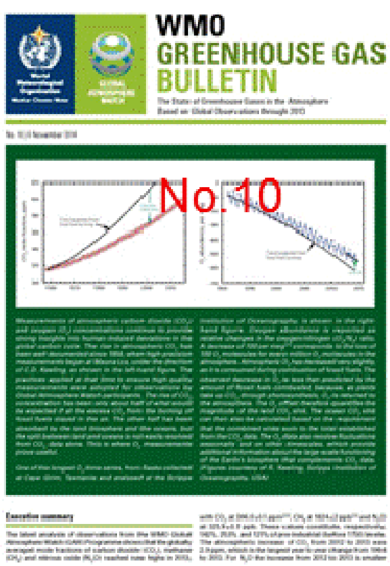
Echo to the WMO GHG Bulletin No.8 (2012), No.9 (2013) and No.10 (2014)

CMA is responsible for the China GHG Bulletin No.1 (2012), No.2 (2013) and No.3 (2014), based on observational datasets that are traceable to the WMO Reference Scales.

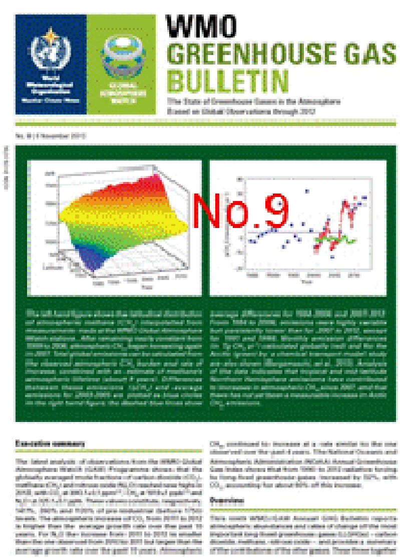

中国温室气体公报

No.1


中华人民共和国国务院新闻办公室
The State Council Information Office of the People's Republic of China
中国气候和中国温室气体公报专题新闻发布会
中国气象局新闻发布会


WMO
GREENHOUSE GAS
BULLETIN
No.10

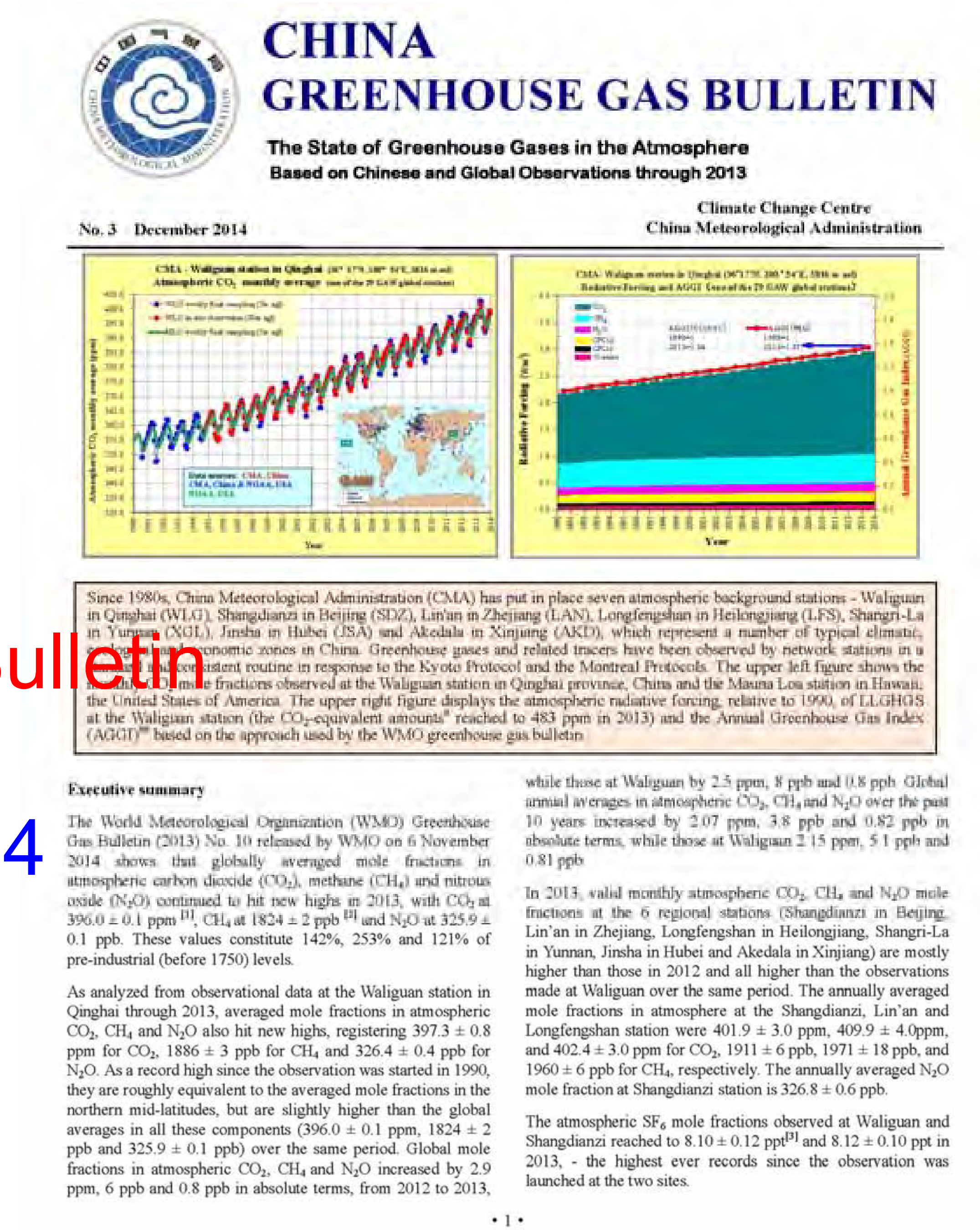

中国温室气体公报
No.3


WMO
GREENHOUSE GAS
BULLETIN
No.9


中国温室气体公报
No.2

China GHG Bulletin No.3

Dec. 2014


CHINA GREENHOUSE GAS BULLETIN

The State of Greenhouse Gases in the Atmosphere
Based on Chinese and Global Observations through 2013

No. 3 December 2014

Climate Change Centre
China Meteorological Administration

Since 1980s, China Meteorological Administration (CMA) has put in place seven atmospheric background stations - Waliguan in Qinghai (WLG), Shangdianzi in Beijing (SDZ), Lin'an in Zhejiang (LAN), Longfengshan in Heilongjiang (LFS), Shangri-La in Yunnan (XGL), Jinsha in Hubei (JSA) and Akedala in Xinjiang (AKD), which represent a number of typical climatic, [illegible]onomic zones in China. Greenhouse gases and related tracers have been observed by network stations in a [illegible] consistent routine in response to the Kyoto Protocol and the Montreal Protocols. The upper left figure shows the [illegible] mole fractions observed at the Waliguan station in Qinghai province, China and the Mauna Loa station in Hawaii, the United States of America. The upper right figure displays the atmospheric radiative forcing, relative to 1990, of LLGHGS at the Waliguan station (the CO_2-equivalent amounts[#] reached to 483 ppm in 2013) and the Annual Greenhouse Gas Index (AGGI)[##] based on the approach used by the WMO greenhouse gas bulletin.

Executive summary

The World Meteorological Organization (WMO) Greenhouse Gas Bulletin (2013) No. 10 released by WMO on 6 November 2014 shows that globally averaged mole fractions in atmospheric carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) continued to hit new highs in 2013, with CO_2 at 396.0 ± 0.1 ppm [1], CH_4 at 1824 ± 2 ppb [2] and N_2O at 325.9 ± 0.1 ppb. These values constitute 142%, 253% and 121% of pre-industrial (before 1750) levels.

As analyzed from observational data at the Waliguan station in Qinghai through 2013, averaged mole fractions in atmospheric CO_2, CH_4 and N_2O also hit new highs, registering 397.3 ± 0.8 ppm for CO_2, 1886 ± 3 ppb for CH_4 and 326.4 ± 0.4 ppb for N_2O. As a record high since the observation was started in 1990, they are roughly equivalent to the averaged mole fractions in the northern mid-latitudes, but are slightly higher than the global averages in all these components (396.0 ± 0.1 ppm, 1824 ± 2 ppb and 325.9 ± 0.1 ppb) over the same period. Global mole fractions in atmospheric CO_2, CH_4 and N_2O increased by 2.9 ppm, 6 ppb and 0.8 ppb in absolute terms, from 2012 to 2013, while those at Waliguan by 2.5 ppm, 8 ppb and 0.8 ppb. Global annual averages in atmospheric CO_2, CH_4 and N_2O over the past 10 years increased by 2.07 ppm, 3.8 ppb and 0.82 ppb in absolute terms, while those at Waliguan 2.15 ppm, 5.1 ppb and 0.81 ppb.

In 2013, valid monthly atmospheric CO_2, CH_4 and N_2O mole fractions at the 6 regional stations (Shangdianzi in Beijing, Lin'an in Zhejiang, Longfengshan in Heilongjiang, Shangri-La in Yunnan, Jinsha in Hubei and Akedala in Xinjiang) are mostly higher than those in 2012 and all higher than the observations made at Waliguan over the same period. The annually averaged mole fractions in atmosphere at the Shangdianzi, Lin'an and Longfengshan station were 401.9 ± 3.0 ppm, 409.9 ± 4.0ppm, and 402.4 ± 3.0 ppm for CO_2, 1911 ± 6 ppb, 1971 ± 18 ppb, and 1960 ± 6 ppb for CH_4, respectively. The annually averaged N_2O mole fraction at Shangdianzi station is 326.8 ± 0.6 ppb.

The atmospheric SF_6 mole fractions observed at Waliguan and Shangdianzi reached to 8.10 ± 0.12 ppt[3] and 8.12 ± 0.10 ppt in 2013, - the highest ever records since the observation was launched at the two sites.

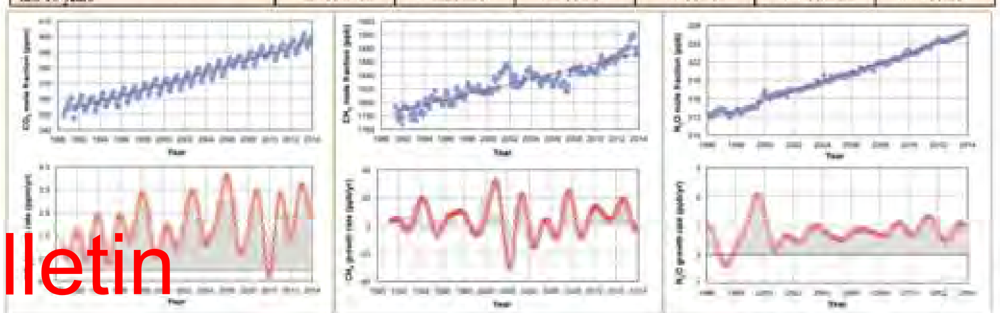
China GHG Bulletin
No.3
Dec. 2014

Overview

The World Meteorological Organization's Global Atmosphere Watch (WMO/GAW) Programme coordinates the systematic observation and analysis of greenhouse gases (GHGs) and other trace species. Through the end of 2013, it enlists 29 global background stations, 400 regional background stations and over 100 contributing stations. Four stations (Waliguan, Shangdianzi, Lin'an and Longfengshan) operated by CMA have been listed in the WMO/GAW directory and the system of GHGs observation, analysis and calibration has been developed there in line with the international framework. Part of the observations by Waliguan and Shangdianzi are accessible to the World Data Centre for Greenhouse Gases (WDCGG) and the global database. The data was widely cited in relevant publications such as WMO GHGs Bulletins and scientific assessments by WMO, United Nations Environment Programme (UNEP) and Intergovernment Panel on Climate Change (IPCC).

The following table provides annually averaged mole fractions of the three major long-lived GHGs as recorded at global level and at Waliguan, China in 2013, and changes in these mole fractions since 2012 and in the last decade. The results are obtained from analysis of observational datasets that are traceable to the WMO World Reference standards.

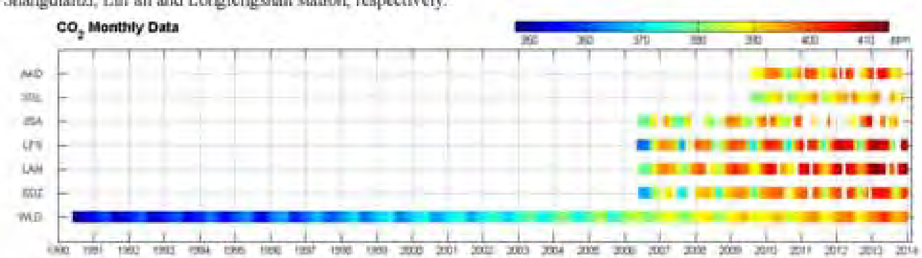
	CO_2		CH_4		N_2O	
	Global	Waliguan	Global	Waliguan	Global	Waliguan
Mean annual mole fraction in 2013	396.0 ± 0.1 ppm	397.3 ± 0.8 ppm	1824 ± 2 ppb	1886 ± 3 ppb	325.9 ± 0.1 ppb	326.4 ± 0.4 ppb
2013 mole fraction relative to year 1750	142%		253%		121%	
2012-2013 absolute increase	2.9 ppm	2.5 ppm	6 ppb	8 ppb	0.8 ppb	0.8 ppb
2012-2013 relative increase	0.74%	0.63%	0.33%	0.42%	0.25%	0.25%
Mean annual absolute increase during last 10 years	2.07 ppm /yr	2.15 ppm /yr	3.8 ppb/yr	5.1 ppb/yr	0.82 ppb /yr	0.81 ppb/yr



Time series and annual increases of the atmospheric CO_2, CH_4 and N_2O mole fractions recorded at Waliguan since its inception in 1990

Carbon dioxide (CO_2)

CO_2 is the most important anthropogenic GHGs in the atmosphere, contributing ~ 65%[1] to radiative forcing by long-lived GHGs. Anthropogenic sources include fossil fuel and biomass combustion, land-use change, etc. CMA began flask air sampling analysis in 1990 at Waliguan. Through 2013, there are seven stations collecting air samples and five stations making in-situ observations. Before the industrial revolution (1750), the globally averaged mole fraction of atmospheric CO_2 was maintained at ~ 278 ppm. Due to the rising impact of human activities, the globally averaged and the Waliguan averaged mole fractions of atmospheric CO_2 in 2013 stood at 396.0 ± 0.1 ppm and 397.3 ± 0.8 ppm, with the mean annual absolute increases during last 10 years at 2.07 ppm and 2.15 ppm. In 2013, valid monthly CO_2 mole fractions at 6 regional stations are mostly higher than those of year in 2012 and the observations made at Waliguan over the same period, with yearly average of 401.9 ± 3.0 ppm, 409.9 ± 4.0ppm and 402.4 ± 3.0 ppm at Shangdianzi, Lin'an and Longfengshan station, respectively.



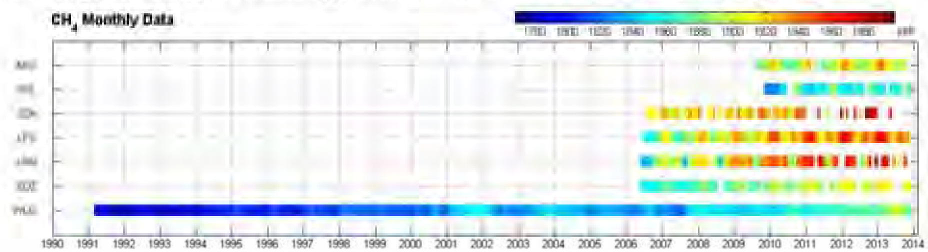
Monthly mean mole fractions of atmospheric CO_2 recorded at seven CMA background stations

China GHG Bulletin No.3

Dec. 2014

Methane (CH_4)

CH_4 is one of the major GHGs that affect the Earth's radiation balance, contributes ~17% to radiative forcing by long-lived GHGs. The atmospheric CH_4 sources come from natural (e.g., wetlands and termites) and anthropogenic (e.g., coal mining, rice plantation, ruminant farming). CMA began to collect samples and make observations at Waliguan in 1990. Through 2013, there are seven stations collecting air samples and five stations making in-situ observations. Before the industrial revolution (1750), the globally averaged mole fraction of atmospheric CH_4 was maintained at ~722 ppb. Due to the rising impact of human activities, the globally averaged and the Waliguan averaged mole fractions of atmospheric CH_4 in 2013 stood at 1824 ± 2 ppb and 1886 ± 3 ppb, with the mean annual absolute increases during last 10 years at 3.8 ppb and 5.1 ppb. In 2013, valid monthly CH_4 mole fractions at 6 regional stations are all higher than those of year in 2012 and the observations made at Waliguan over the same period, with yearly average of 1911 ± 6 ppb, 1971 ± 18 ppb and 1960 ± 6 ppb at Shangdianzi, Lin'an and Longfengshan station, respectively.



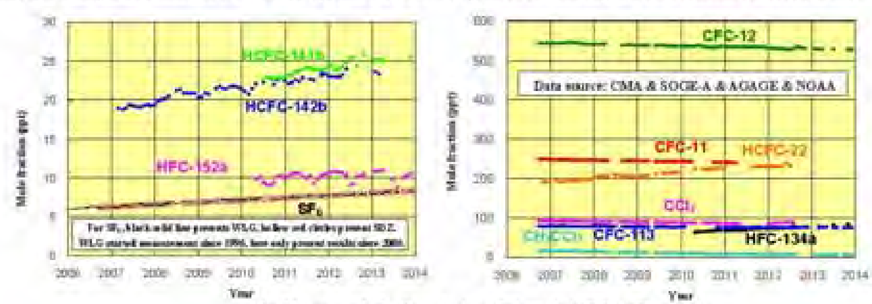
Monthly mean mole fractions in atmospheric CH_4 recorded at seven CMA background stations

Nitrous oxide (N_2O)

N_2O is the third most influential GHGs in the atmosphere, contributes ~6% to radiative forcing by long-lived GHGs. The increased N_2O in the atmosphere is mainly attributed to farmland soil emission resulting from the excessive use of agricultural nitrogen fertilizer. CMA began to collect samples and make observations at Waliguan in 1990. Through 2013, there are seven stations collecting air samples and four stations making in-situ observations. Before the industrial revolution (1750), the globally averaged mole fraction of atmospheric N_2O was maintained at ~270 ppb. Due to the rising impact of human activities, the globally average and the Waliguan averaged mole fractions of atmospheric N_2O in 2013 stood at 325.9 ± 0.1 ppb and 326.4 ± 0.4 ppb, with the mean annual absolute increases during last 10 years at 0.82 ppb and 0.81 ppb. In 2013, valid monthly N_2O mole fractions at 6 regional stations are mostly higher than those of year in 2012 and the observations made at Waliguan over the same period, with yearly average of 326.8 ± 0.5 ppb at Shangdianzi station.

Halogenated greenhouse gases

Halogenated GHGs refer to a group of GHGs that contain halogen atoms (fluorine, chlorine etc) in their molecules. Almost all generated from human activities and mainly used as refrigerants, blowing gents, aerosol agents, cleaning agents, fire extinguishing agents, solvents and insulators. In total they contribute ~12% to radiative forcing by long-lived GHGs, including sulphur hexafluoride (SF_6), HFCs and PFCs regulated by the Kyoto Protocol, and CFCs, HCFCs, etc, regulated by the Montreal Protocol. CMA began to collect samples and making observation of SF_6 at Waliguan in 1996. The in-situ observation of halogenated GHGs was begun at Shangdianzi in 2006 and weekly sampling at five stations since 2010. The ozone-depleting substances (ODS), which are being phased out in China, include CFCs, Halons, CH_3CCl_3 and CCl_4. These have all begun to decline, while their replacements, e.g. HCFCs and HFCs are increasing rapidly in the atmosphere. Among them, the atmospheric SF_6 mole fractions observed at Waliguan and Shangdianzi reached 8.10 ± 0.12 ppt and 8.12 ± 0.10 ppt in 2013 - the highest ever records observed at the two sites.



Monthly mean mole fractions of selected halogenated GHGs at Shangdianzi

China GHG Bulletin
No.3
Dec. 2014

Relevant information

CMA's GHG stations and their commencement year

Station	Carbon Dioxide (CO_2)	Methane (CH_4)	Nitrous Oxide (N_2O)	Sulfur Hexafluoride (SF_6)	Other halogenated GHGs
Waliguan in Qinghai (WLG)	1990	1990	1996	1996	2010*
Shangdianzi in Beijing	2006	2006	2006	2006	2006
Lin'an in Zhejiang (LAN)	2006	2006	2006	2006	2010*
Longfengshan in Heilongjiang (LFS)	2006	2006	2006	2006	2010*
Shangri-La in Yunnan (XGL)	2009	2009	2009*	2009*	2011*
Jinsha in Hubei (JSA)	2006*	2006*	2006*	2006*	
Akedala in Xinjiang (AKD)	2009*	2009*	2009*	2009*	

Note: 1) * indicates weekly air sampling analysis only, while others indicate co-located weekly air sampling analysis and in-situ observation.
2) The Bulletin, released once per year, is based on observational datasets of GHGs that are traceable to the WMO World Reference Scales. These scientifically defensible data sets are produced with an approach consistent with WMO guidelines and recognized QA/QC procedures. They are regularly updated and periodically revised by small amounts should the international calibration scales be adjusted.

[1] ppm = number of molecules of the gas per million (10^6) molecules of dry air.
[2] ppb = number of molecules of the gas per billion (10^9) molecules of dry air.
[3] ppt = number of molecules of the gas per trillion (10^{12}) molecules of dry air.
[4] Refer to the WMO Greenhouse Gas Bulletin, this percentage is calculated as the relative contribution of the mentioned gas(es) to the increase in global radiative forcing caused by all long-lived gases since 1750.
\# **CO_2-equivalent amounts:** The equivalent CO_2 concentrations corresponding to the total radiative forcing of LLGHGS. It is derived with the relationship between CO_2 concentrations and radiative forcing from LLGHGS.
\#\# **Annual Greenhouse Gas Index (AGGI):** The ratio of the total direct radiative forcing due to long-lived greenhouse gases for any year for which adequate global measurements exist to that which was present in 1990.

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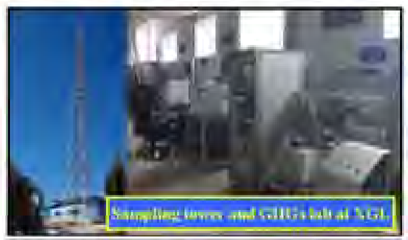


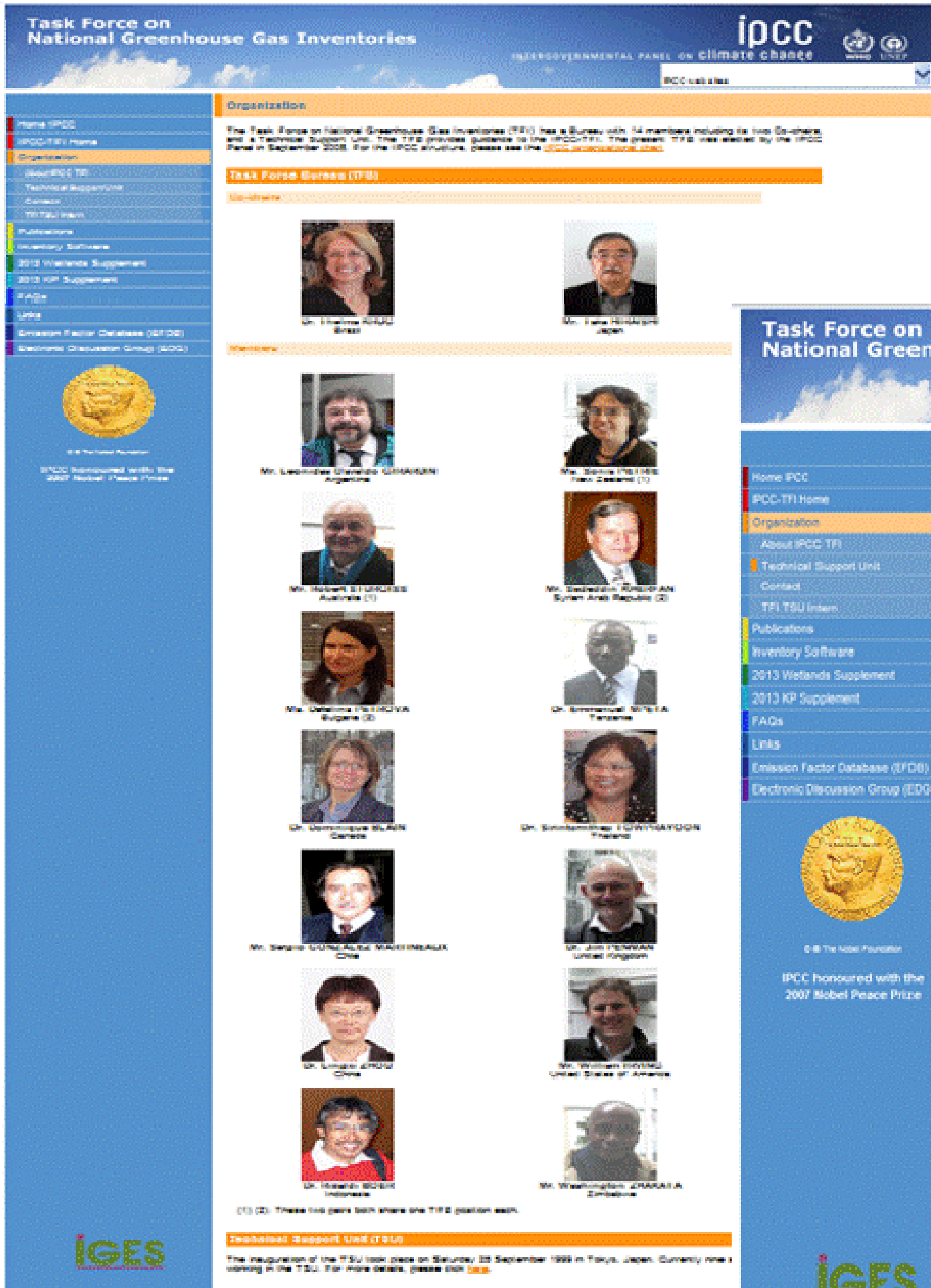
Sampling tower and GHGs lab at XGL

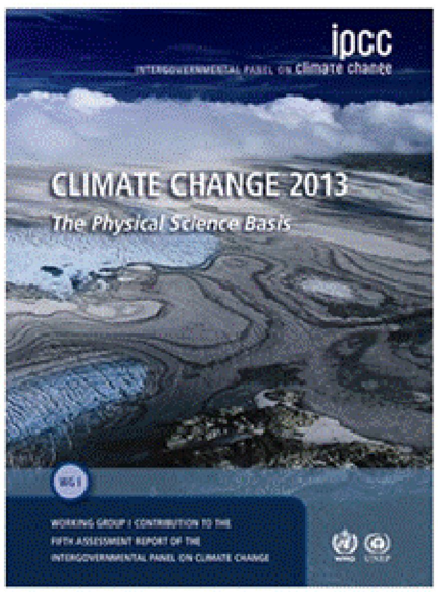
The **Shangri-La** (27°29′ N, 99°00′ E, 3580m asl.), one of the three CMA's newly built regional stations, representing the regional atmospheric conditions of western part of the Yunnan-Guizhou Plateau. The GHGs flask sampling program started at 2009 and in-situ measurements started at 2010. Equipped with in-situ and air sampling systems, it observes such elements as CO_2, CH_4, CO, N_2O, SF_6 and other halogenated GHGs, and stable isotopes of CO_2.

CMA's Calibration Lab for GHGs (CCL-China)

CMA's Calibration Laboratory for Greenhouse Gases & Related Tracers **(CCL-China)** was responsible for sample analysis, calibration, system design & development, and procedure optimization of the observational network and scientific collaborative stations. The lab propagates and distributes working standards linked to the WMO-CCL and relevant international reference scales (signed CIPM-MRA in April 2010) and provides analyses and calibrations for CO_2, CH_4, N_2O, SF_6, HFCs, PFCs, CO, CFCs, HCFCs, Halons and stable isotopes of CO_2 with high accuracy and compatibility. The lab also provides services to domestic research communities.

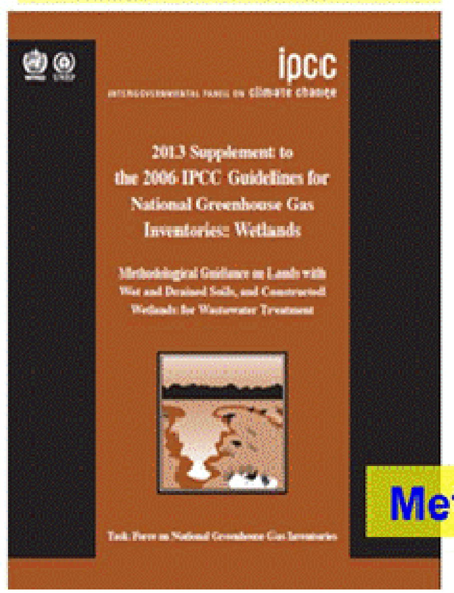
IPCC-TFI
TFB, TSU

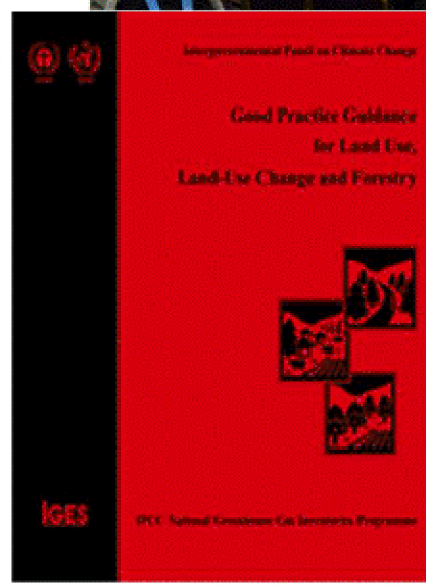




IPCC AR5

IPCC-TFI





Methodology Reports

To serve the needs of expanding GHG measurement and application and better contribute to the global network one of the CMA's efforts is to form a National Central Calibration Lab (CCL) with tight linkage to the WMO CCLs, particularly the one for GHGs, which is operated by NOAA.

In recent years comparisons with CIPM-related institutions (International Committee for Weights and Measures)

April 2010: CIPM Mutual Recognition Arrangement

The World Meteorological Organization (WMO) has become the second intergovernmental organization to join the CIPM MRA.

→ Climate change - WMO signed the CIPM MRA!

The "WMO-BIPM Workshop on Measurement Challenges for Global Observation Systems for Climate Change Monitoring: Traceability, Stability and Uncertainty" was held from 30 March to 1 April 2010, at the WMO headquarters in Geneva, Switzerland, under the chairmanship of Prof. Andrew Wallard (BIPM) and Dr Wenjian Zhang (WMO).

At the occasion of the Workshop, the World Meteorological Organization (WMO) joined the CIPM MRA. The signature ceremony took place on 1 April 2010, when Michel Jarraud, Secretary General of the WMO, signed the Arrangement on behalf of the WMO.

WMO与CIPM

温室气体观测标准互认协议

WMO-BIPM Workshop on Measurement Challenges for Global Observation Systems for Climate Change Monitoring: Traceability, Stability and Uncertainty
30 March-1 April 2010

Source of information: http://www.bipm.org/en/cipm-mra/

China National GHG Metrology Working Group

http://www.cngaw-ghgs.org

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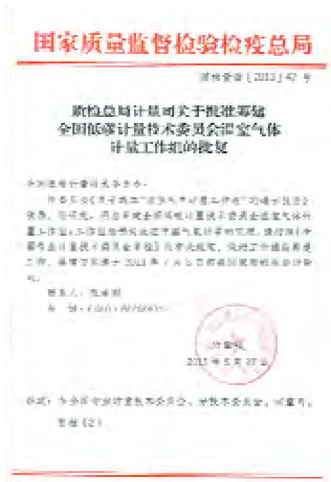

Inter-comparison Experiment among a number of Chinese labs

分析要素	中国环境科学研究院	国家海洋环境监测中心	国家卫星气象中心	中国海洋大学	环境保护部标准样品研究所	中国气象局广州热带海洋气象研究所	中国大气本底基准观象台	武汉区域气候中心	中国气象科学研究院	合计
所在城市	北京	辽宁大连	北京	山东青岛	北京	广东广州	青海西宁、海南州	湖北武汉	北京	
缩写	CRAES	NMEMC	NSMC	OUC	IERM	ITMM	CGAWBO	WRCC	CAMS	
CO_2 (360-580 ppm)	√	√	√		√	√	√	√	√	
CH_4 (1800-2100 ppb)	√	√	√	√		√	√	√	√	
CO (0-600 ppb)							√		√	
N_2O (290-350 ppb)	√	√		√		√	√		√	
SF_6 (~9 ppt)							√		√	
仪器	GC	CRDS/NDIR、CRDS/GC-FID、GC-μ ECD	LGR-GGA温室气体分析仪	GC	GC	CRDS	CRDS/GC	CRDS	CRDS/GC	
倾向于盲样比对分析的日期	2014-09	2015年春季	2014-07	2014-09-12	2014-08-18	2015-06	2014-10	2014-10～2014-12		
总时间需求（天）	30	30	30	20	10	30	60	7	30	247
大致耗气量（升）	4	4	18	2	10			12	30	80
联系人	马占云	翟卫东	张兴赢	张桂玲	田文	邹宇	刘鹏	王凯	姚波	
电话	84915154	13387862072	13811539852	13697686750	13901057255	15920580617	13997380908	13545072570	13911376162	
比对分析时间	2014-12	2015-2	2014-8	2014-09	2015-1	2015-4	2014-10	2014-11	2014-8、2015-5	
最晚寄出盲样时间	2015-1-20	2015-3-31	2014-9-15	2014-10-15	2015-1-31	2015-4-30	2014-11-20	2014-12-15		
比对顺序	6	8	2	3	7	9	4	5	1、10	

盲样分析结果表-1

气瓶收到日期	201 年 月 日																		
气瓶寄出日期	201 年 月 日																		
实验室名称	地点	开始分析日期	结束分析日期	要素浓度（摩尔比）	仪器类型	生产厂家及型号	溯源的标准	气瓶1 瓶号：JA03010				气瓶2 瓶号：JA02994				气瓶3 瓶号：JB03041			
								初始压力 psi		终了压力 psi		初始压力 psi		终了压力 psi		初始压力 psi		终了压力 psi	
								浓度	SD	分析次数	总耗气量（psi）	浓度	SD	分析次数	总耗气量（psi）	浓度	SD	分析次数	总耗气量（psi）
				CO2 (ppm)															
				CH4 (ppb)															
				CO (ppb)															
				N2O (ppb)															
				SF6 (ppt)															

盲样分析结果表-2

气瓶收到日期	201 年 月 日																		
气瓶寄出日期	201 年 月 日																		
实验室名称	地点	开始分析日期	结束分析日期	要素浓度/比值	仪器类型	生产厂家及型号	溯源的标准	气瓶1 瓶号：JB03048				气瓶2 瓶号：JB03047				气瓶3 瓶号：JA02986			
								初始压力 psi		终了压力 psi		初始压力 psi		终了压力 psi		初始压力 psi		终了压力 psi	
								浓度/比值	SD	分析次数	总耗气量（psi）	浓度/比值	SD	分析次数	总耗气量（psi）	浓度/比值	SD	分析次数	总耗气量（psi）
				CO2 (ppm)															
				$\delta^{13}C$ (‰)															
				$\Delta^{14}C$ (‰)															

Thank you