Achievements and prospects of the CMA-NOAA bilateral cooperation on GHGs

Ling-Xi Zhou & colleagues

Chinese Academy of Meteorological Sciences (CAMS)
China Meteorological Administration (CMA)

21-22 May 2013, Boulder
Outline

- CMA’s role in the WMO/GAW
- CMA-NOAA bilateral
- Products & Services
- Prospects
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CMA represents the WMO’ Commission for Atmospheric Sciences (CAS) in China and is deeply involved in the WMO's GAW Program.

WMO EC 65
Geneva, May 2013
GAW 2013 Symposium
18-20 March 2013
WMO Secretariat, Geneva
Salle Obasi

GAW 2005 (Geneva, 14-16 March)

GAW 2009 (Geneva, 5-7 May)
5th WMO Round-Robin

Lingxi ZHOU¹, D.R. Kitzis², P.P. Tans², K. Masarie², D. Chao²

Referee since 2002

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

GGMT-2011
16th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases, and Related Measurement Techniques

25-28 October 2011, Wellington, New Zealand
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 WMO Secretariat made the following announcement: "On 1 April 2010, when Michel Jarraud, Secretary-General of the WMO, signed the Arrangement on behalf of the WMO..."
17th WMO/IAEA Meeting on CO₂, Other GHGs, and Related Measurement Techniques (GGMT-2013), Beijing, China, June 10-14.

Facsimile

From: Secretary-General
To: Dr Zheng Guoguang
Permanent Representative of China with WMO
Date: 18 June 2011
City: BEIJING
Subject: 17th WMO/IAEA Meeting of Experts on Carbon Dioxide, Other Greenhouse Gases, and Related Tracer Measurement Techniques

Dear Dr Zheng,

I would like to bring to your attention the activities of the WMO Global Atmosphere Watch (GAW) Programme addressed in the understanding of the global carbon cycle and the role of the greenhouse gases in the climate system. Global observations and analysis of the key greenhouse gases coordinated by WMO/GAW help Members in taking informed action to mitigate carbon emissions globally. Harmonized observations and stringent requirement to the quality of measurements are essential for the high products and services. As part of Quality Assurance Framework for greenhouse gases, WMO/GAW works biennially with the International Atomic Energy Agency (IAEA) to review scientific understanding of greenhouse gas emissions and sinks, and to examine data quality objectives and measurement techniques. The 16th WMO/IAEA Meeting of Experts on Carbon Dioxide, Other Greenhouse Gases, and Related Tracer Measurement Techniques (GGMT-2011) took place in Wellington, New Zealand, from 26 to 28 October 2011, hosted by the National Institute for Water and Atmospheric Research (NIWA).

The meeting came to a general agreement reflected in the meeting recommendations that it would be desirable to convene the next meeting, the 17th WMO/IAEA Meeting of Experts on Carbon Dioxide, Other Greenhouse Gases and Related Tracer Measurement Techniques (GGMT-2013), in a developing country with a rapidly expanding greenhouse gas measurement programme such as China. China would be particularly suitable in that the systems being developed there under Prof. Lingxi Zhou’s guidance are fully aligned with the WMO/GAW network. This meeting could be scheduled the week before or the week after the International Carbon Dioxide Conference taking place in Beijing, China, from 3 to 7 June 2013. Prof. Zhou of the China Meteorological Administration (CMA) stated that she would be interested to be the lead organizer if the CMA would be willing to host the meeting.

The China Meteorological Administration (CMA) contributes to the global activities on greenhouse gases observations and their quality control. The CMA has been represented in the past 3 GGMT meetings (in 2001, 2003, 2005, 2007, 2009 and 2011). At the previous meetings the
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NOAA and CMA have been working cooperatively in recent years to increase the number of high quality observations of GHGs in China and to coordinate efforts on data management, quality control, and product development.

Workshop on High-Accuracy Greenhouse Gas Measurement

Mary M. Glackin with the CMA GHGs delegation, Sept. 2010
The 17th Joint Working Group Session on Cooperation in the Field of Atmospheric Science and Technology between NOAA and CMA (Sept. 2010)

No.48 Affirmed our mutual commitment to strengthening joint research between the NOAA and CMA through the U.S.-China S&T Agreement to develop accurate and reliable capabilities for observing and understanding the behavior of GHGs in the atmosphere.
In further cooperation with AGAGE and other international groups

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

Moreover, discrete air sampling started in succession at several cooperating sites.
Challenge for Accurate and Compatible Measurement of Atmospheric Greenhouse Gases

Ling-Xi Zhou & Colleagues

Chinese Academy of Meteorological Sciences (CAMS)  
China Meteorological Administration (CMA)

3-4 Sept. 2012, Beijing  
Workshop on Measurements and Standards for Climate Change
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A number of background stations were developed in addition to the one at Mt. Waliguan, which is one of the 28 WMO/GAW baseline stations.
WLG (GAW global station)
LAN (GAW regional station)
LFS (GAW regional station)
XGL (GAW regional station)

香格里拉CO₂/CH₄浓度高分辨率在线（2010.7）

梯度采样塔
梯度进气系统（2010.5）
CAMS Lab in Beijing (GHGs & tracers)
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.

Data submit to the WDCGG

Global-View => ObsPack

CT-China
From 3 x 2° to 1 x 1°

Triple-nested mesh
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.
Task Force on National Greenhouse Gas Inventories

TFB 2008 - 2015

Task Force on National Greenhouse Gas Inventories
China Greenhouse Gas Bulletin

The State of Greenhouse Gases in the Atmosphere
Based on Chinese and Global Observations through 2011

Executive Summary:
The World Meteorological Organization (WMO) Greenhouse Gas Bulletin (2012) No. 8 released by WMO on 19 November 2012 shows that globally averaged mole fractions in atmospheric carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) continued to hit new highs in 2011, with CO₂ at 392.0 ± 0.1 ppm, CH₄ at 1813 ± 2 ppb and N₂O at 329.2 ± 0.3 ppb. These values constitute 140%, 259% and 272% of pre-industrial levels (1750s).

As analyzed from observational data at the seven China Meteorological Administration (CMA) background stations through 2011, averaged mole fractions in atmospheric CO₂, CH₄, and N₂O also hit new highs in 2011, with the Waiqiao station in Gansu registering 392.2 ppm for CO₂, 1886 ppb for CH₄, and 329.7 ppb for N₂O. As a record high since the observation was started in 1990, they are roughly equivalent to the average mole fractions in the northern mid-latitudes, but are slightly higher than the global average in all three components (CO₂, CH₄, and N₂O) increased by 3.3 ppm, 5 ppb and 1.0 ppb in absolute terms, from 2009 to 2011, while those at Waiqiao by 2.2 ppm, 9 ppb and 1.1 ppb.

Global annual averages in atmospheric CO₂, CH₄, and N₂O over the past 10 years increased by 2.6 ppm, 3.2 ppb and 0.76 ppb in absolute terms, while those at Waiqiao 2.1 ppm, 3.5 ppb and 0.80 ppb.

As observed by the three regional stations of Langfang in Hebei, Beijing and Lishui in Zhejiang in 2011, the annual averaged mole fraction in atmospheric CO₂ were 395.9 ppm, 395.3 ppm and 397.2 ppm, while CH₄ 1915 ppb, 1916 ppb and 1909 ppb, and N₂O 325.9 ppb, 324.8 ppb and 325.3 ppb, all being higher than the observations made at Waiqiao (398.3 ppm, 1885 ppb and 330.0 ppb) over the same period. This is somewhat a reflection of the anthropogenic impact more active in and around the three regional background stations.

The atmospheric SF₆ mole fraction observed at Waiqiao and Shanghai reach 734 pg/m³ and 732 pg/m³ in 2011, the highest ever records since the observation was launched at the two stations.
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December 2009, CMA
March 2013
CMA GHGs Lab
18th CMA-NOAA JWG proposal
Integrated Approaches of GHGs Monitoring and Verification

• Cooperative surface flask sampling extension
• Cooperative high accuracy vertical profiles
• PFP and AirCore analysis techniques
• Extensive ICP and Interactive Data Visualization
• Data assimilation, higher resolution CT and Validation
• CCL-China for GHGs tight link to WMO/CCLs
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, ……