WDCGG's Activities
-after Last Physical Meeting-

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Regular Publications

Since ET-WDC, 22-24, May 2012, Geneva

- **WMO GHG Bulletin #8, 19 November 2012**

  -> COP 18, 26 Nov – 7 Dec, Doha, Qatar

- **WDCGG Data Summary #37, 1 March 2013**

  (VOC chapter 11 introduced)

- **WMO GHG Bulletin #9, 6 November 2013**

  -> COP 19, 11-22 Nov, Walsaw, Poland

- **WDCGG Data Summary #38, 1 March 2014?**

  (VOC chapter 11 will be enhanced)

Important Meetings

Since ET-WDC, 22-24 May 2012, Geneva

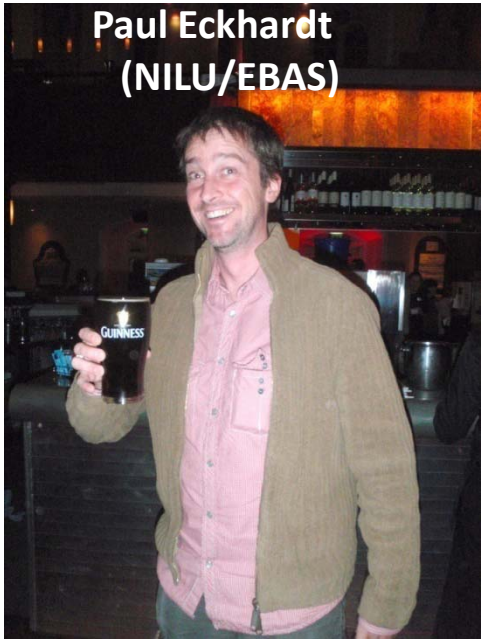
- **Air Quality Metadata WS, 5-7 Sep 2012, Dublin**
- **GAW Symposium 2013, OPAG-EPAC JSC, 18-20 Mar 2013, Geneva**
- **SAG-GHG/GGMT-2013, 9-14 Jun 2013, Beijing**
- **International WS on GAW Programme in Tropical Regions, 11-12 Sep 2013, Jakarta**
- **SAG-RG, 13-15 Nov 2013, Garmisch-Partenkirchen**
- **CAS-TECO, CAS-16, 18-26 Nov 2013, Antalya**

Air Quality Metadata Workshop

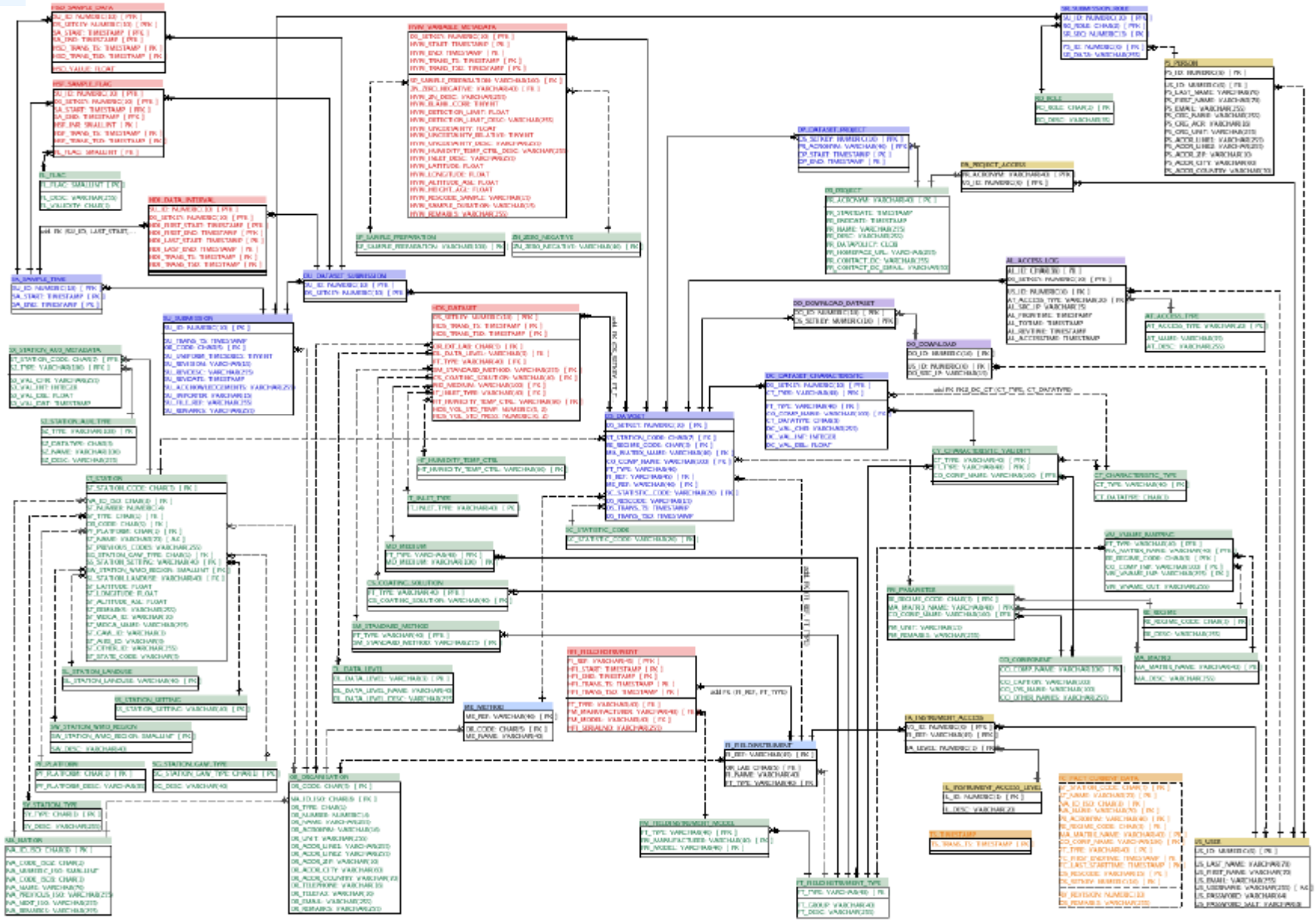
GEO AQ CoP

Dublin, Ireland in Sep 2009

Best Practices for Interoperability
for the Air Quality Community



New Database Structure by Paul Eckhardt (NILU/EBAS)



GAW Symposium 2013, OPAG-EPAC JSC

18-20 Mar 2013, Geneva

Recent Progress and Vision in Japanese GAW Activities

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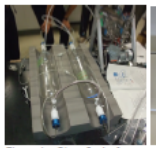
Greenhouse Gases

In addition to the operational measurements of major GHG species at Minamitorishima site (GAW global station), the Japan Meteorological Agency (JMA) started a series of cooperative measurements with several research laboratories in Japan at the site. The additional measurement items are shown in Table1. This activity is a part of comprehensive research measurement programme using a competitive research fund (Global Environment Research Account for National Institute) of Ministry of Environment during 2011 to 2013.

From February 2011 onward, JMA started operational airplane observations of CO_2, CH_4, N_2O and CO along the flight route between Tokyo and Minamitorishima once in a month (see the separated poster presented by Takatsuji et al.)

Table 1. Measurement gas species at the Minamitorishima site.

	Measurement Labo	Gas Species	Sampling
JMA	(Japan Meteorological Agency)	CO_2, CH_4, CO, O_3 (operational measurements)	Continuous
MRI	(Meteorological Research Institute)	H_2, Rn	Continuous
NIES	(National Institute for Environmental Studies)	O_2/N_2, Halocarbon	Flask
AIST	(National Institute of Advanced Industrial Science and Technology)	CO_2 isotopic ratio	Flask



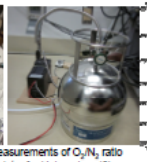


Figure 1. Glass flasks for measurements of O_2/N_2 ratio (2.5L; left) and a stainless canister for Halocarbon (6L; right) used at Minamitorishima.

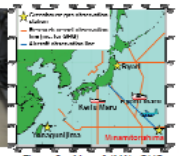


Figure 2. Map of JMA's GHG observation stations and lines.

The Ozone Layer

JMA operationally monitors the ozone layer at four domestic sites and one Antarctic site (Sapporo, Tsukuba, Naha, Minamitorishima and Syowa Station in Antarctica) with three instruments shown in Figure 3.

Figure 3. Ozone layer monitoring by an automated Dobson ozone spectrophotometer (left), a balloon-bone ozonesonde with an electrochemical concentration cell (ECC) (middle: at Showa station in Antarctica), and Brewer spectrophotometers (right) .

The Regional Dobson Calibration Centre (RDCC) for Asia for the parameter of total ozone is operated by the JMA. Dobson regional intercomparisons were held in 1996, 2003, 2006 and 2011 at the JMA Aerological Observatory in Tsukuba Science City, about 60km northeast of Tokyo. The latest intercomparison was held from August to September 2011 and two Chinese experts participated (Figure.4).

Figure 4. Dobson regional intercomparison held by RDCC Japan at the Aerological Observatory in Tsukuba.

Solar and Downward Longwave Radiation

JMA started enhanced radiation observations at five stations in Japan, which joined to the Baseline Surface Radiation Network (BSRN), in March 2010. The observation data are reported to the World Radiation Data Centre (WRDC) regularly to detect important radiation field changes at the surface of the Earth relating to climate change.

Figure 5. Radiation instruments at Minamitorishima.

Figure 6. Precision Filter Radiometer (PFR) measuring aerosols at Ryori.

Aerosol

In January 2010, JMA started near-real-time data transmission of Aerosol Optical Depth (AOD) at Ryori, one of the GAW Precision Filter Radiometer (PFR) stations (Figure 6), to the World Optical Depth Research and Calibration Center (WORCC) to contribute to the GOS-GAW Pilot Project on the Improvement of aerosol data dissemination through the WMO Information System (WIS).

Model Products

JMA operates numerical global aerosol model to forecast the emission and transportation of Kosa (Aeolian dust), as well as global chemistry transport models to forecast total ozone amounts, the UV index and the photochemical oxidants. JMA also produces CO_2 distribution maps from model calculations using an inversion method based on data reported to the World Data Centre for Greenhouse Gases (WDCGG).

JMA plans to upgrade its global aerosol model, chemistry transport models and CO_2 transport model in a few years, and also plans to introduce a regional chemistry transport model and data assimilation systems with ensemble Kalman filter to improve Kosa, ozone and CO_2 forecast and analysis products.

WDCGG

The World Data Centre for Greenhouse Gases (WDCGG) supported by JMA started harmonized service with WMO Information System (WIS) as newly designated Data Collection or Production Centre (DCPC) in WIS framework since August 2011. ISO compliant metadata from WDCGG are delivered together with all other WMO data catalogues with wider Discovery, Access and Retrieval (DAR) function of WIS, facilitating the data exchange within and beyond WMO programmes. Focused data could be downloaded directly from the WDCGG respecting the GAW data policy.

In the combined issue of the annual WDCGG Data Summary , GAS for reactive gases and WDCGG cooperatively provided a new chapter on VOCs including the global analysis of ethane (Figure 7).

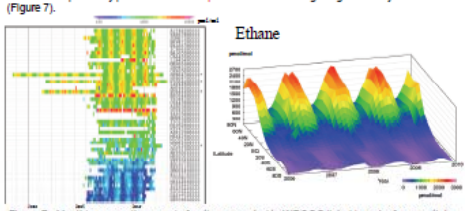


Figure 7. Monthly mean ethane mole fractions reported to WDCGG listed in order from north to south (left; asterisk (*) shows the sites with continuous measurements), variation of zonally averaged monthly mean mole fractions (right), from WDCGG Data Summary No.37 (in press).

WCC and Domestic Alliance with National Metrology Institute in GHG measurements

In harmony with the BIPM/WMO MoU in the international sector, JMA and other major observation laboratories in Japan have established a domestic alliance with the National Metrology Institute of Japan (NMIJ). To establish consolidated and stable gas-measurement standards and to ensure inter-comparable datasets produced by the laboratories, they started series of intercomparison activities named IceGGO (InterComparison Experiments for Greenhouse Gases Observations) since 2012 onward. The first experiment for methane (IceGGO-1(CH_4)) was conducted in tandem with a GAW WCC's methane round robin. The redundant samples (methane in air) produced by NMIJ for the purpose of the CCQM-K82 (CH_4) intercomparison and WCC's reference gases were circulated and measured as a package.

Figure 8. GHG Measurement Standards Working Group meeting chaired by Prof. Takakiyo Nakazawa with the National Metrology Institute of Japan.

Figure 9. Cylinders used on IceGGO-1(CH_4) intercomparison experiment: the NMIJ produced (left 2 cylinders); WCC's reference gases (middle 2 cylinders); JMA's added gases (right 2 cylinders).

JMA aircraft observation of atmospheric CO_2, CH_4, CO and N_2O in the mid-troposphere over the western North Pacific

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Abstract

- The Japan Meteorological Agency (JMA) has started an operational aircraft observation of greenhouse gases as a new atmospheric monitoring activity in 2011.
- The observed mole fractions suggest the influence from anthropogenic/biospheric sources/sinks in East and South Asia.
- The data is available from WMO/GAW the World Data Centre for Greenhouse Gases (WDCGG). http://ds.data.jma.go.jp/gmd/wdcgg/wdcgg.html

1. JMA aircraft observation

Figure 1. (A) is a cargo aircraft C-130H, and (B) is the island, Minamitorishima.

Japan Meteorological Agency (JMA) has started an operational aircraft observation of greenhouse gases as a new atmospheric monitoring activity in 2011. A cargo aircraft C-130H in Japan Ministry of Defense is used for the flask sampling observation during a regular flight between Atsugi and Minamitorishima once a month.

The air samples are collected during a cruising flight at about 6 km over the western North Pacific as well as a descending to Minamitorishima. After the flight, we measure 4 trace gas mole fractions of carbon dioxide (CO_2), methane (CH_4), carbon monoxide (CO), and nitrous oxide (N_2O) at JMA, Tokyo.

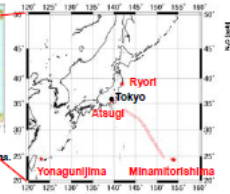


Figure 2. Locations of the air samples collected from flights between Atsugi and Minamitorishima. JMA operates 3 GAW stations; Ryori, Yonagunijima, and Minamitorishima.

2. Air sampling onboard the aircraft

Sample air is taken from an air-conditioning blowing nozzle upstream of the recirculation fan to avoid the contamination of cabin air. We prepared a 1.7-L titanium flask of which internal surface is coated by silicon. Air samples are pressurized into the flasks by a manual diaphragm pump to an absolute pressure of about 0.4 MPa. The storage tests for the flask samples during several days were repeated to ensure the stability of trace gases until analyses.

A manual diaphragm pump — Air sampling onboard the aircraft — A flask

Figure 3. The air sampling equipments.

3. New measurement system for flask sampled air

The JMA/MRI developed the automated measuring system for flask sampled air including recently advanced spectroscopic instruments. High-precision analyses were estimated by the experiments using standard gases and natural air samples.

Figure 4. New measurement system at JMA, Tokyo.

Species	Measurement techniques	Analyzer
CO_2	Non Dispersive Infrared Absorption Spectrometry	Li-cor LI7000
CH_4 (CO_2, H_2O)	Wavelength-Scanned Cavity Ring Down Spectroscopy (WS-CRDS)	Picarro G2301
CO	Vacuum Ultraviolet Resonance Fluorescence (VURF)	Aero-Laser AL5002
N_2O (CO, H_2O)	Off-axis Integrated Cavity Output Spectroscopy (Off-axis ICOS)	Los Gatos DLT100

Table 1. Measurement techniques used for flask sampled air.

4. Result of the observation

① Seasonal changes of mole fractions ② Vertical profiles of mole fractions

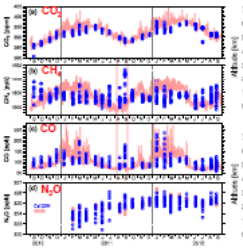


Figure 5. Time series of observed mole fractions of CO_2 (a), CH_4 (b), CO (c) and N_2O (d). The blue circles are flight data, and the red lines and circles are station data of Minamitorishima.

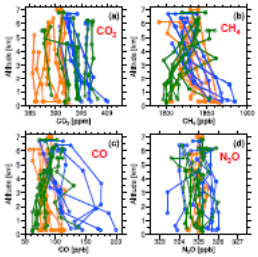


Figure 6. Vertical profiles of observed mole fractions, obtained in the latitudinal range of 24.2–25.5° N, for CO_2 (a), CH_4 (b), CO (c) and N_2O (d).

③ High CH_4 mole fractions in the mid troposphere

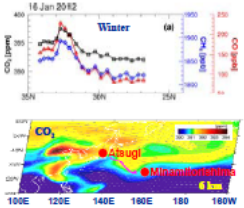


Figure 7. Latitudinal profiles of CO_2, CH_4, and CO. (a) is 16 January 2012, and (b) is 12 September 2011.

Figure 8. CO_2 distribution at a height of 6km calculated by three-dimensional transport model (NICAM-TM).

Figure 7(a) shows horizontal mole fraction profiles of CH_4 and CO observed on 16 January 2012. A CH_4 mole fraction peak was observed with a concomitant CO peak. Moreover, the flight observed a CO_2 mole fraction peak at the same time.

Figure 7(b) shows horizontal mole fraction profiles observed on 12 September 2011; CH_4 variation with extremely high mole fractions correlated well with that of CO. In contrast to the winter-spring flights, the September flight did not observe any high CO_2 mole fractions.

The significant correlation of CH_4 with CO in the mid-troposphere indicates that the observed air masses originated from combustion sources in Asia, as was the case during winter–spring. However, compared to CO, larger values of CH_4 were observed in summer–fall than in winter–spring. These higher CH_4 contributions likely came from increase of biogenic sources during summer. The surface station rarely observes such high CH_4 mole fractions.

Continuation of this aircraft measurement program for many years would promote our understanding of the spatial variations of the greenhouse gas fluxes in Asia and of those long-term variations induced by the rapidly growing human activities and climate change.

SAG-GHG/GGMT-2013

9-14 Jun 2013, Beijing, China

SAG-GHG/GGMT-2013

- The plan for WDCGG reform strategy was presented to seek feedback from participants
- A questionnaire survey on the selection of metadata elements was carried out to the contributors and the users in GGMT
- The time series of the global analyses (global averaged time series of CO_2, CH_4, N_2O) shown in WMO Greenhouse Gas Bulletin are uploaded in WDCGG web site (on 17th July 2013) after consultation with GHG-SAG
- A tiny group for GHG data archiving is established.

NOAA/ESRL
Ken Masarie →

ICOS/ATC
← Lynn Hazan

International WS on GAW Programme in Tropical Regions

11-12 Sep 2013, Jakarta

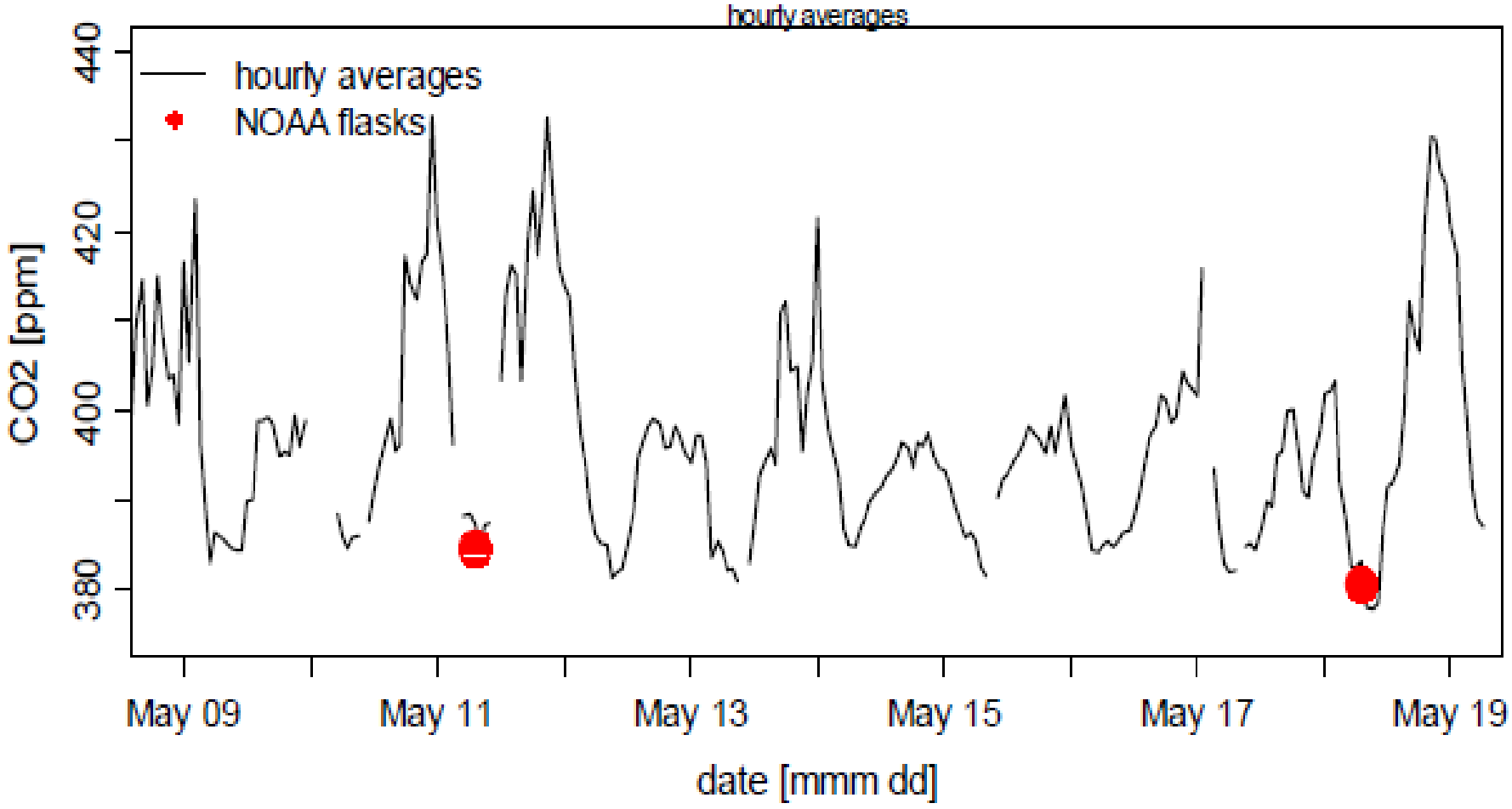
International WS on GAW Programme in Tropical Regions

11-12 Sep 2013, Jakarta

- BMKG (Indonesian Agency for Meteorology, Climatology and Geophysics) started to operate domestic GHG flask sampling since 2012. They introduced the same type glass flasks as NOAA and started the measurements in Jakarta. This work is supported by Dr. Martin Steinbacker in EMPA.
- Strong expectation was shown to emerging countries to support GAW programme.

Charcteristics of GHG data in pristine rain forest

Continuous (by EMPA) vs Flask (by NOAA)

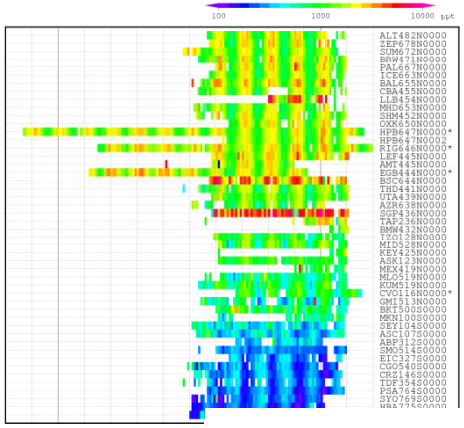


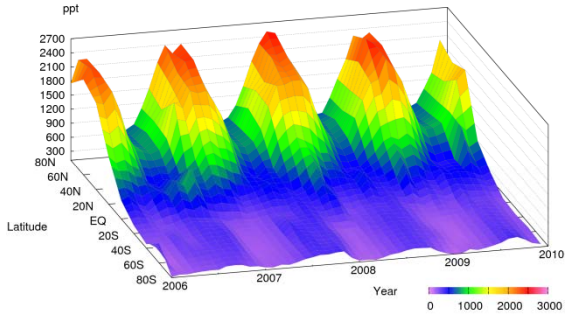
By Dr. Martin Steinbacker

SAG-RG

13-15, Nov. 2013, Garmisch-Partenkirchen

- WDCGG presented its reform plan and basically approved.
- Newly planned WMO RG Bulletin was proposed and adopted. -> The work schedule is earlier than GHGs.
- Plate figures and carpet figures are evaluated useful and encouraged to be provide an interactive drawing tool of these figures for any available parameters.





CAS-TECO, CAS-16

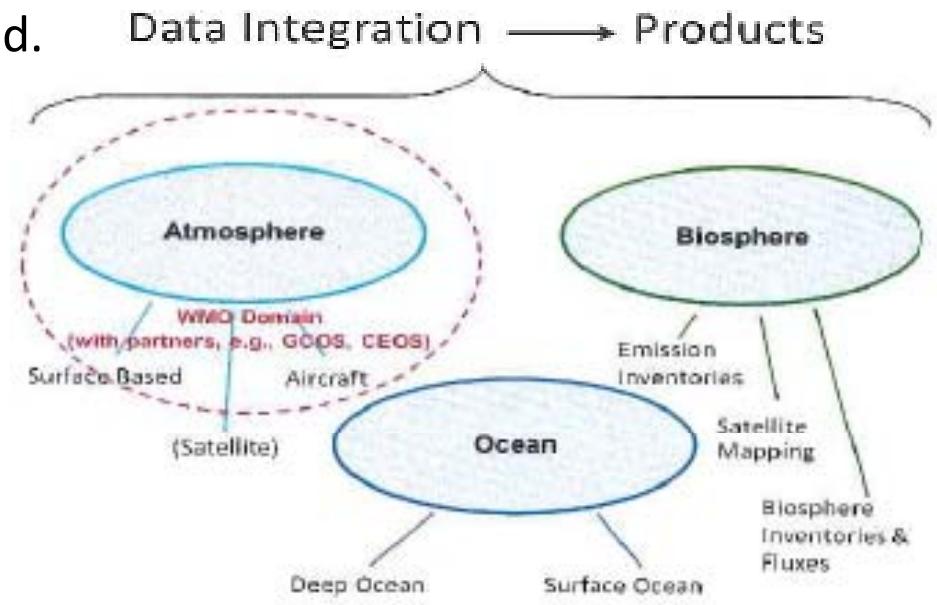
18-26, Nov. 2013, Antalya

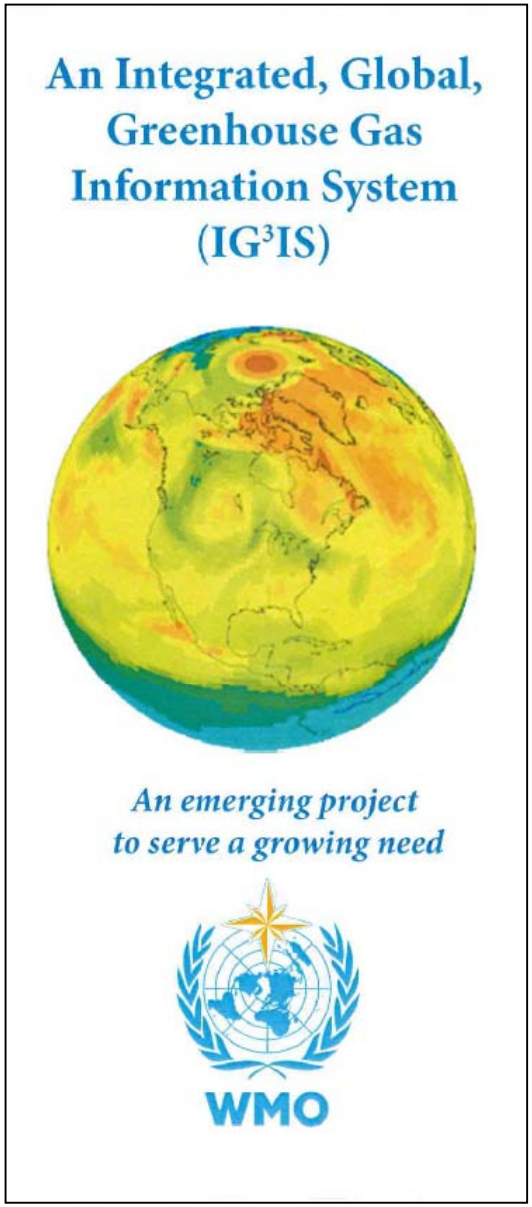
CAS-16 approved para 6.2.1.3:

"... The Commission expressed gratitude to the GAW data contributors from all over the world for their quiet dedication and perseverance, and among others, particularly to those at background stations located at high mountains, isolated islands, and in pristine tropical forests or frozen zones, where living itself poses sometimes many difficulties."

http://cas-16.wmo.int/documents-english

IG^{3}IS was approved.





Latest Topics on UN Climate Summit

- UN Climate Summit will be held on 23rd Sep 2014. WDCGG is requested to provide its global GHG analysis to issue WMO GHG Bulletin before this event .
- SAG GHG chair proposed an enhanced cover story to draw public attention to GAW GHG measurements programme.

Future Perspectives

WMO OMM GAW

WIS, Other Scientific Community

GAW Data Policy
GAW Strategic Plan

GHG-SAG
RG-SAG

Scientific Advisory

WDCGG

JMA

International Contribution

- **Commit to align the needs of users and submitters alike.**
- **Permanent maintenance of DATA archives**
- **Quality assurance and control for scientific accountability**
- **Better notification and compliance of the data policy**
- **Enhance interoperability**

Data submitters

Monitoring: Data Registration Number

- Simplification of reporting procedure
- Preparation of the user Information for submitters
- Feedback Information on Characteristics of Data
- Enhance the relationship between submitters and the data centre

Data users

Monitoring:
Download Number
Google Scholar Hit Number

- Improved interface
- Consolidated flagging
- Tools for better data use
- Preparation of ISO compliant metadata
- Provision of reliable products (Data assimilation)

IPCC
UNFCCC

Road Map 2013-2016

2013 | 2014 | 2015 | 2016

▲GGMT-2013 / SAG-GHG

▲ SAG-RG

▲GGMT-2015 / SAG-GHG

▲ SAG-RG

Survey

▲Survey for requirement

New WDCGG

New format, metadata item

New (Meta)Database

Web interface → Beta version → Release!

Current WDCGG

Operation as usual → System / Data frozon

Guide

Preparing Draft → Release!

▲Consultation

LETKF CO_2 Data Assimilation

Develop CO_2 Data Assimilation System → WDCGG product?

▲JMA operation start

Thank you for your Attention!

[Back] H.Tanaka, M.Takahashi, T.Sasaki, H.Koide,
Te.Kawasaki , Ta.Kawasaki
[Front] M.Yamamoto, T.Nakamura, Y.Sannohe (From left to right)

harerun

Japan Meteorological Agency
WMO World Data Centre for Greenhouse Gases