Traceability for monitoring greenhouse gases and WCC Invitation

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(KRISS)

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Share of standardization between WMO and BIPM

since MOU on 10 October 2001

to achieve Global Harmonization of GHGs measurement scale and accurate observation temporally and spacially

In March, 2010 the joint workshop named “Measurement Challenges in Global Observation Systems for Climate Change Monitoring: traceability, stability and uncertainty” was held at WMO headquarter.

Cooperation between WMO and BIPM

- **Absolute Scales**
  - Traceable to SI unit (mol/mol)
  - Gravimetric method: Purity analysis, Weighing, Stability
    Internal consistency
  - Reproducible within uncertainty (Quality System)
- **Transfer Standards**
  - high Precision of measurement
  - Stability of cylinder with a given term
  - Comparable between each products

Traceability and Harmonization

Key Comparisons for the demonstration of equivalency between NMI's in their analytical capability to certify the composition of gas mixtures (analytical comparison) and their capability to prepare SI-traceable gas measurement standards (preparative comparison)

National Metrology Institutes (NMI)

- **Highest authority in metrology**
- **Maintain the national measurement standards**
  - Directly traceable to primary standards when NMI realize the SI units of measurement standards
- **Responsible for disseminating the national measurement standard**

✓ To accomplish well above missions and verify themselves

- Key Comparison (KC) + Quality System (Peer review, 2007)
- publish a list of Capability of Measurement and Calibration (CMC) through international review on the best measurement capability of each NMI, which is open to public through web (www.bipm.org)

Traceability of KRISS GHGs

- 2002 CCQM-P41 Greenhouse gases (CO_2 and CH_4 in air)
- 2004 CCQM K15 CF_4 and SF_6 emission level (coordinating Lab)
- 2006 CCQM K52 CO_2 in nitrogen, ambient level
- 2007 CCQM K51 CO in nitrogen, 5 μmol/mol
- 2008 CCQM K68 N_2O in air, ambient level (coordinating Lab)

RRT (GAW activity)

- JMA CH_4 RRT: 2001, 2005, 2007, 2009년
- WMO RRT : 2008 ~ (CO_2, CH_4, N_2O, SF_6, CO)

GHGs measurement capability improvement

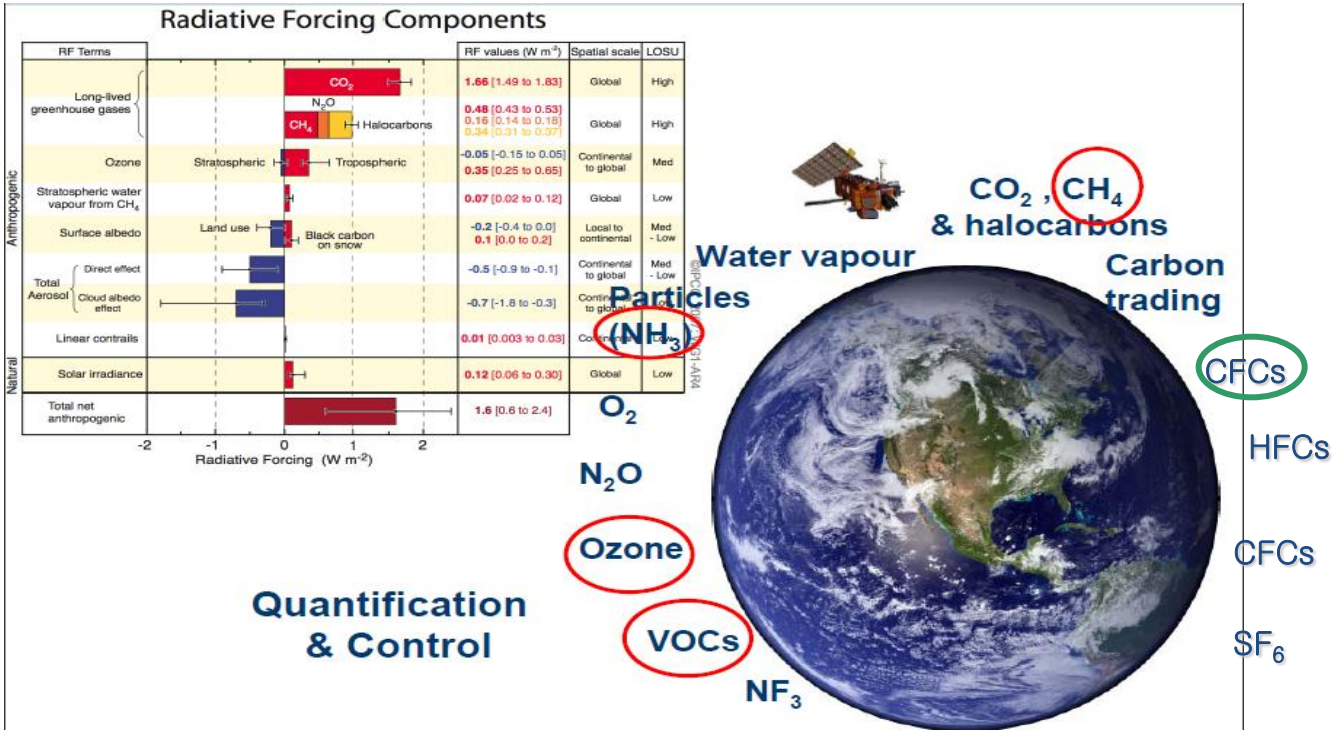
- Proficiency test CO_2, N_2O, CO

Next preparative Intercomparisons for monitoring Climate Change Gases

2010-2011 CO CCQM-K84 (Coordinating by KRISS)

2011-2012 CFC-11, CFC-12, CFC-113 (Coordinating by NIST)

CH_4 (Coordinating by BIPM)



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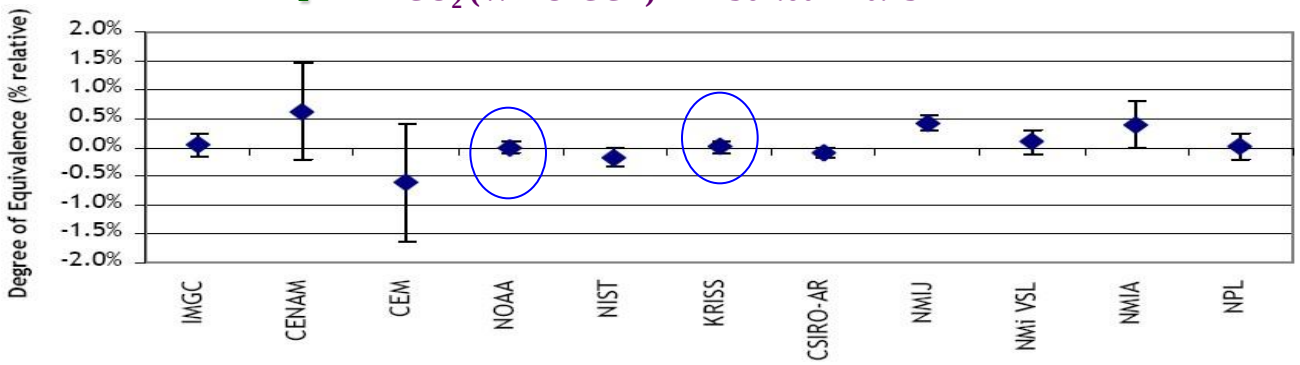
CCQM-P41 (2003)

- Coordinating Lab: VSL (Netherland)
- Subatance: CO_2 and CH_4 ambient level

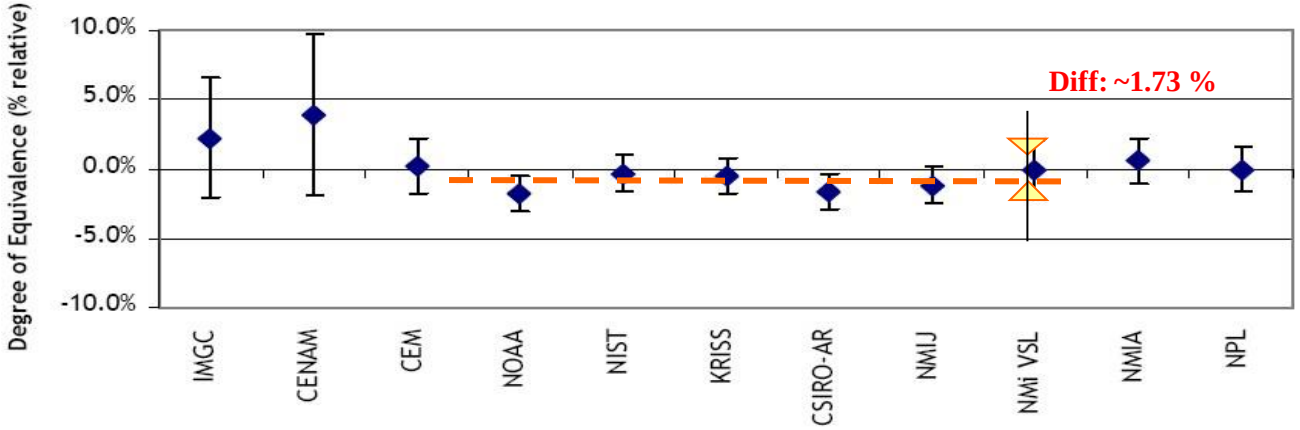
CO_2

CO_2 (KRISS) **364.61 ± 0.05**
CO_2 (WMO-CCL) **364.60 ± 0.13**



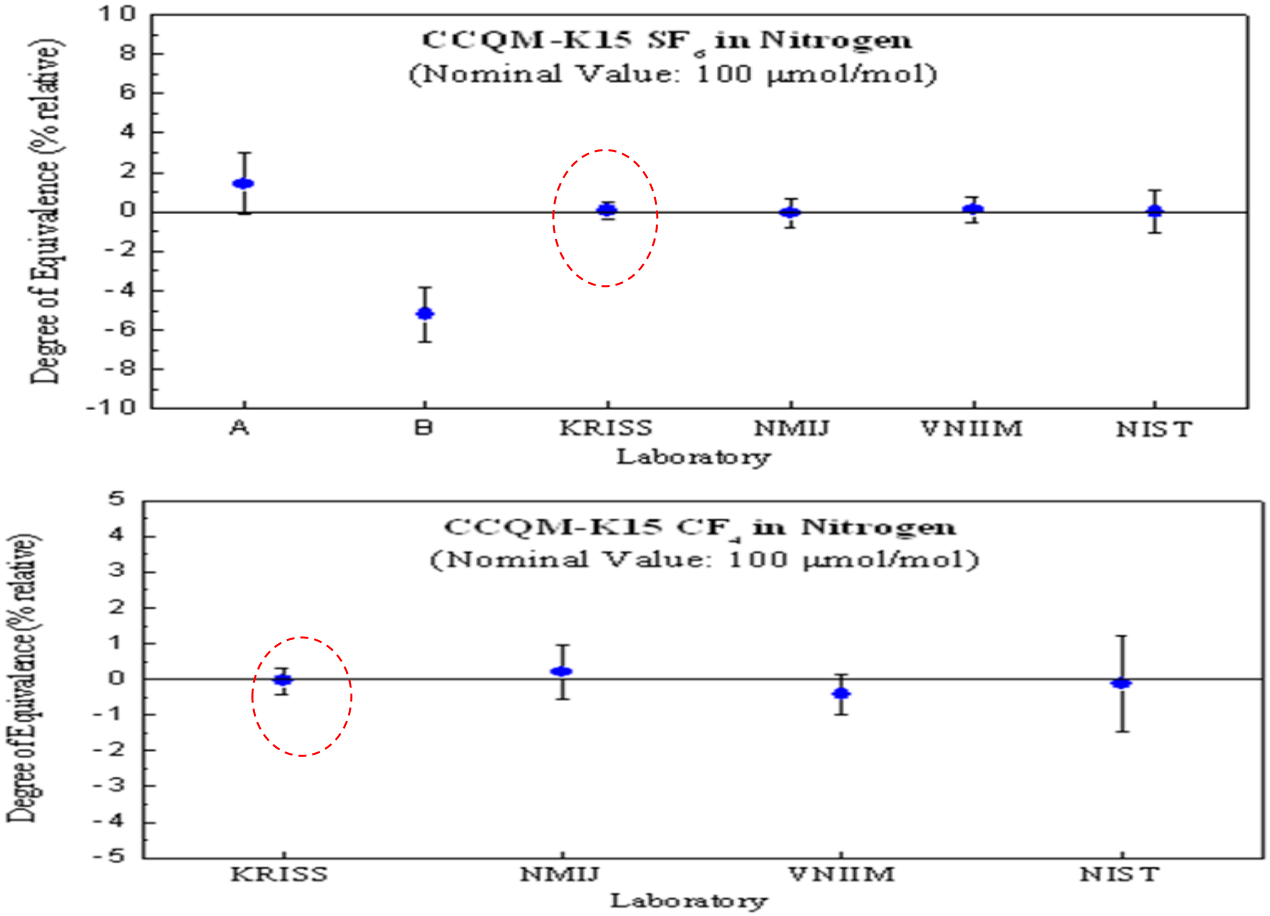
CH_4

CH_4 (KRISS) **1.792 ± 0.002** → **Diff: ~1.3 %**
CH_4 (WMO-CCL) **1.769 ± 0.0006**



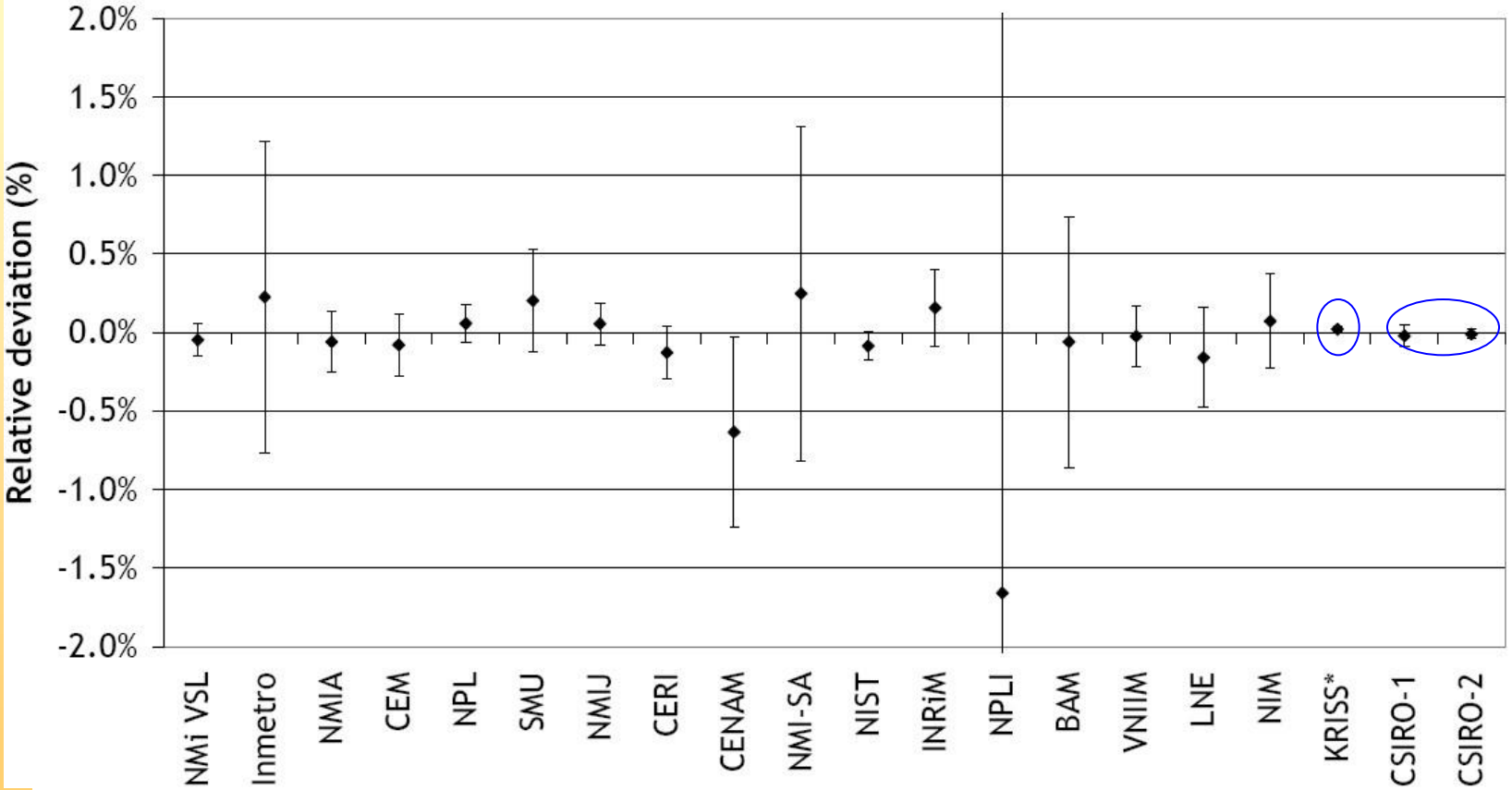
CCQM-K15 (2003)

- Coordinating Lab: KRISS
- Subatance: SF_6 & CF_4 hundred μmol/mol level



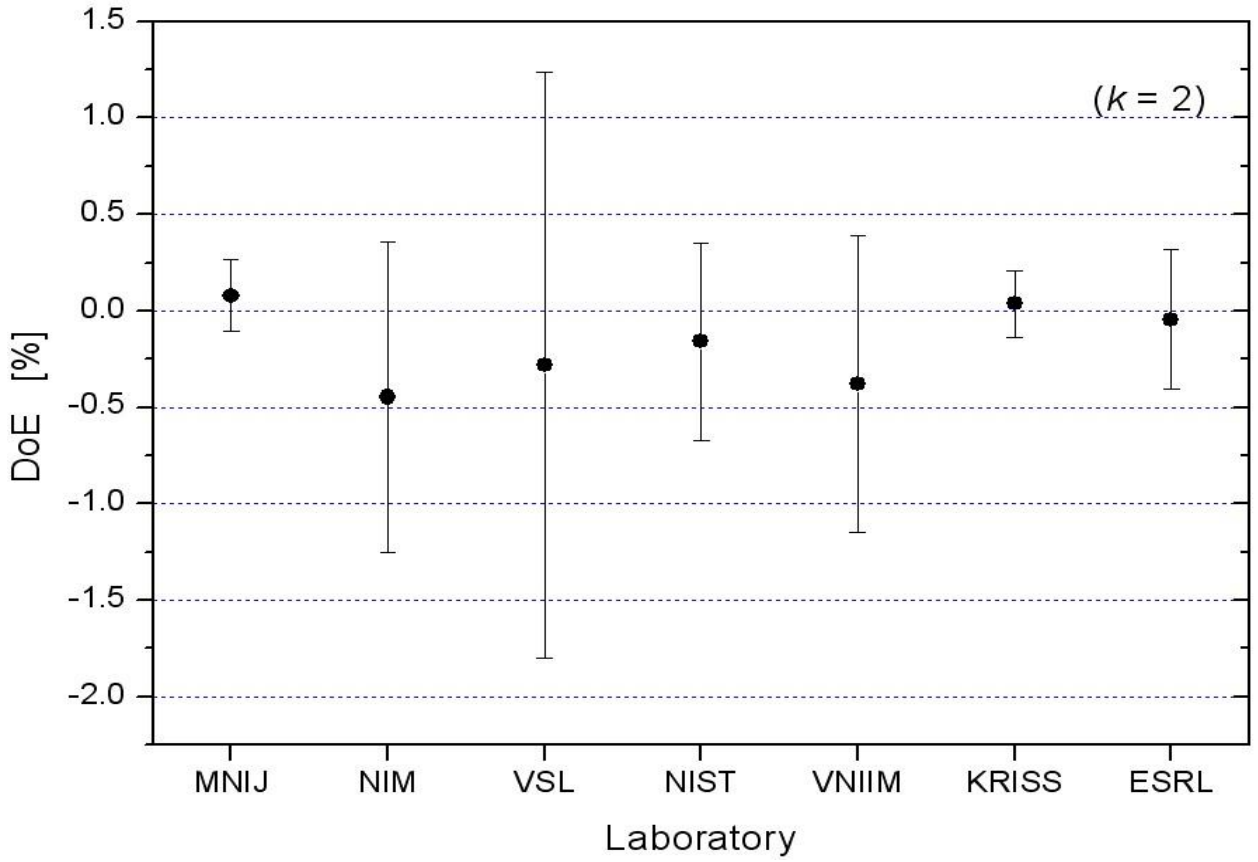
CCQM-K52 (2008)

- Coordinating Lab: VSL (Netherland)
- Subatance: Carbon dioxide in Synthetic Air



CCQM-K68 (2010)

- Coordinating Lab: KRISS
- Subatance: Nitrous oxide 320 nmol/mol in Synthetic Air



Ref: Draft B report in 2010

Results of Methane Reference Gas intercomparisons in Japan (2008–2009)

Laboratory and Location	Date of Measurement	Cylinder Number						instrument
		CPB13002			CPB13003			
		Concen-tration (ppb)	SD (ppb)	No	Concen-tration (ppb)	SD (ppb)	No	
JMA Tokyo, Japan	May. 1, 2008	1664.4	1.2	10	1848.4	1.8	10	SHIMADZU GC-14BPF
KRISS Daejeon, RP Korea	Sep. -Nov., 2008	1665.1	0.2	5	1851.2	0.2	5	HP-6890
KMA Anmyeon-do, RP Korea	Oct. –Nov., 2008	1665.6	1.2	12	1851.3	1.4	12	HP-6890
CMA Mt. Waliguan, China	Apr. 3-5, 2009	1661.1	0.9	14	1847.0	0.8	14	Agilent-6890N
	Apr. 13-14, 2009	1662.3	0.2	9	1847.2	0.3	9	Picarro G1301
	Apr. 14-16, 2009	1659.3	5.2	10	1846.1	1.9	10	HP-5890
CMA Beijing, China	Apr. 28-29, 2009	1661.9	2.0	10	1847.5	0.6	10	Agilent-6890N
	Apr. 29, 2009	1662.5	0.2	9	1847.3	0.1	9	Picarro G1301
	Apr. 30,2009	1662.2	1.6	12	1847.2	1.8	12	Agilent-6890N
JMA Tokyo, Japan	Jul. 1, 2009	1664.3	1.1	10	1846.8	1.7	10	SHIMADZU GC-14BPF

- The KRISS Scale agree with the NOAA Scale within about 4 ppb.

Japan Meteorological Agency (JMA), Chinese Academy of Meteorological Sciences (CMA)

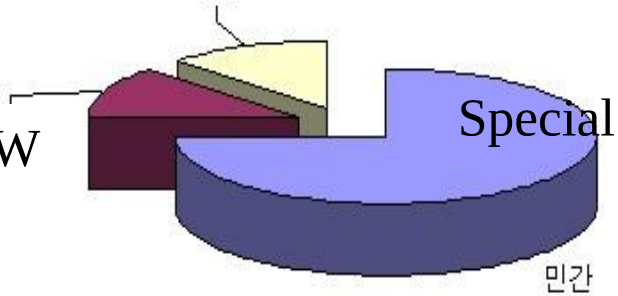
PT (2006-2007): Methane in air

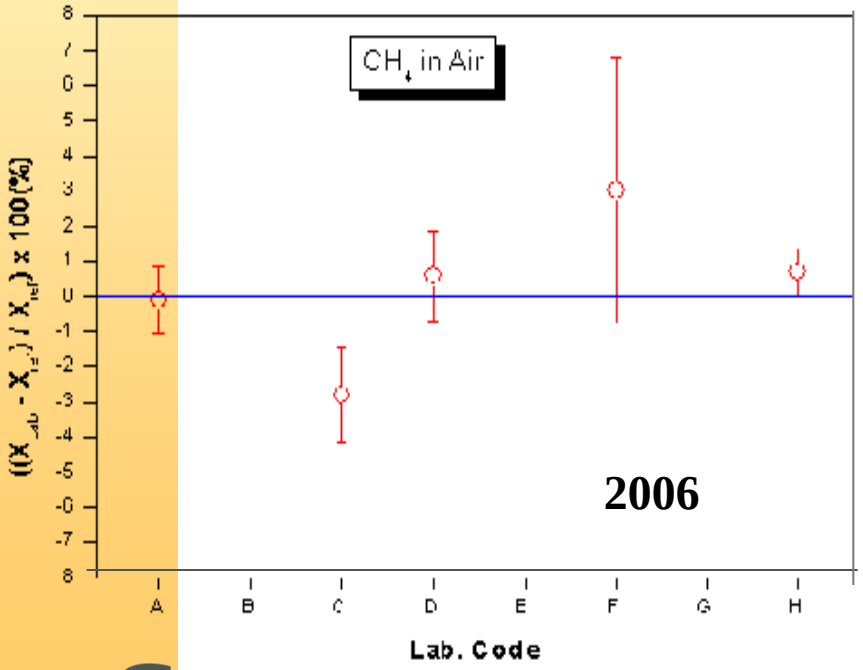
- Participants:

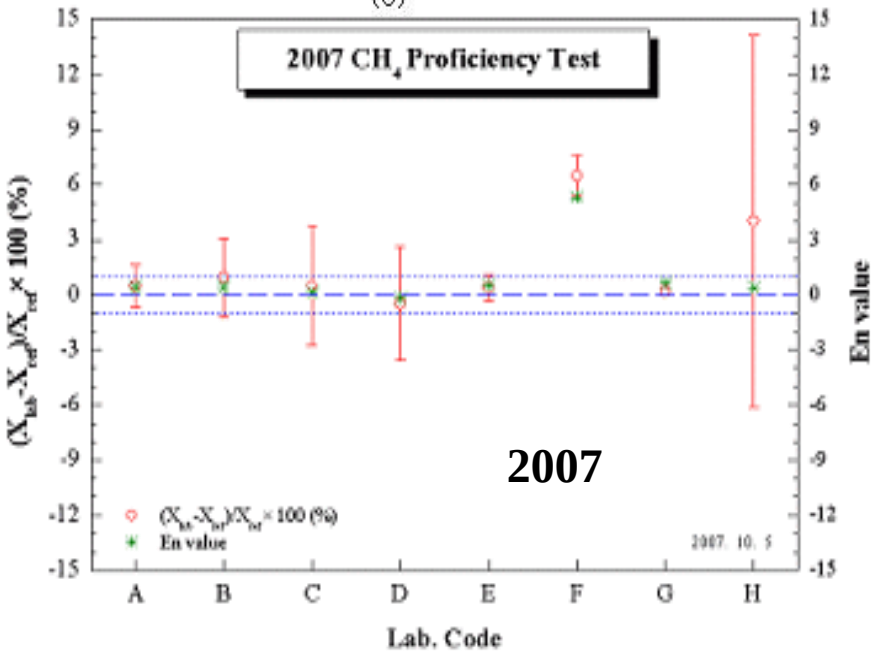
Environmental agency

KMA/GAW

Special gas company







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Share of standardization between KMA and KRISS

기상청 Korea Meteorological Administration KRISS

MOU, 2010

(establishment of Memorandum of understanding)

- Agree with mutual cooperation
  - Against climate change
    1. Greenhouse gas analysis for air sampled by flight
    2. WCC establishment
  - Measurement of Earth magnetic field

Overview of cooperation bet. KRISS and KMA

○ Development of PSM for monitoring GHGs

- developed

CO_2, CH_4, N_2O, CFCs, SF_6, PFCs(SF_6, CF_4), HFC23

- will be developed

δ13C, δ18O, D, CO, HFCs and HCFCs, NF3, H_2

○ Distribution of CRM for monitoring GHGs to KGAWC

- participation of CH_4 RRT and WMO RRT

- distribution of TS

○ technical support measurement and analysis for monitoring GHGs

- application of remote controlled monitoring techniques

KRISS GAW activity

- Develop and Maintain primary standard mixtures
  - ➢ which are traceable to SI unit (mol/mol)
    - Primary method (Gravimetric method)
  - ➢ support KMA technically
    - for data to be Reproducible within uncertainty (Quality System)
    - for a new measurement instrument to be reliable
- Supporting their QS by distributing TS of compressed air with
  - highly precision such as a level of WMO-GAW recommended precision
  - good stability of cylinder
  - traceable to PSM
  - Comparable to each producers (Harmonization)

Project Name :

Establishment of foundation for WCC designate

- Invitation of World Calibration Center (WCC)

  - variables : SF_6 (in detail at the poster)

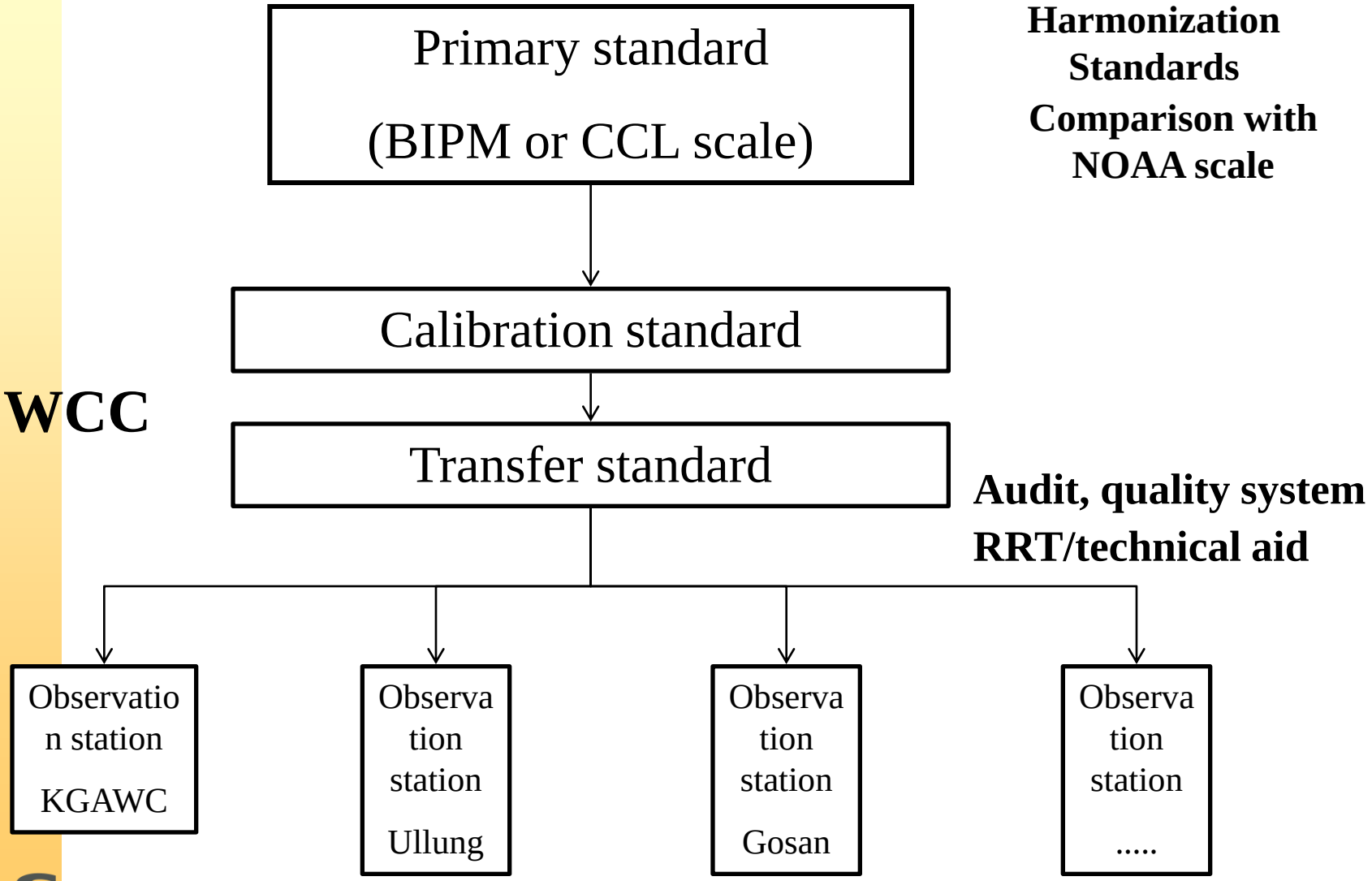
  - Standard scale should be traceable to SI, so is maintained by the KRISS.

  - KMA plays a role as a responsible organization of the WCC for SF_6.

- 2nd East Asia workshop and Training

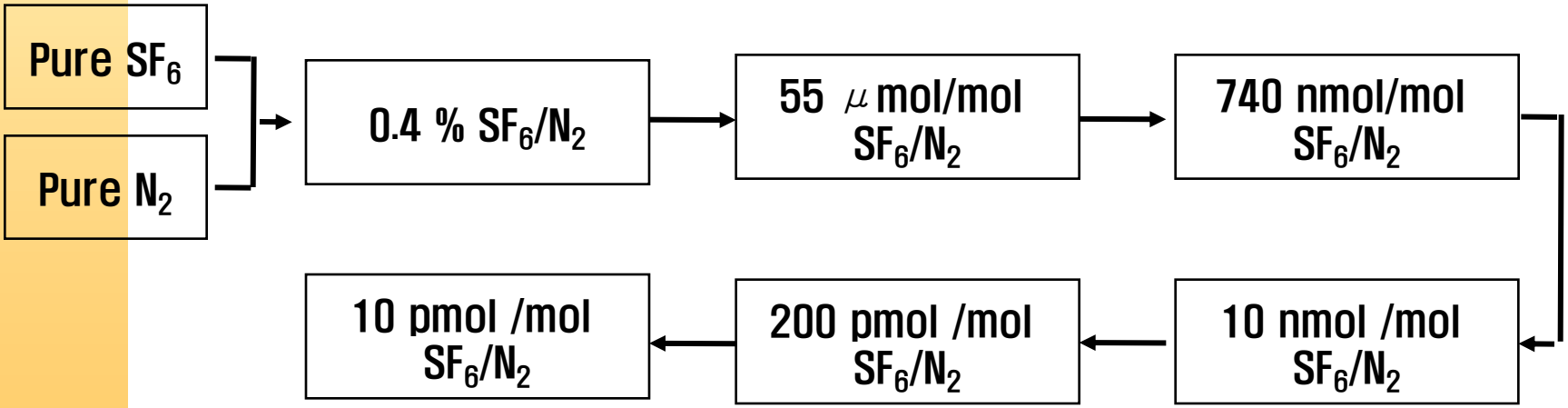
- Participation RRT and performing Proficiency test

Traceability of calibration



Preparation of standard gas mixture SF_6

- By gravimetry method with 6 step dilution from pure SF_6 and N_2
  - Several ppt level of SF6 cylinders
  - Analyzer: GC/ECD (uncertainty < 5 %)



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GAW recommended level: ± 0.02 ppt

GAW facilities for GHGs

Variable	QA/SAC	Central Calibration Laboratory (CCL) Host of Primary Standard	World Calibration Centre (WCC)	Regional Calibration Centre (RCC)	World Data Centre (WDC)
CO_2	JMA (A/O)	ESRL	ESRL EMPA		JMA
CH_4	Empa (Am, E/A) JMA (A/O)	ESRL	Empa (Am, E/A) JMA (A/O)		JMA
N_2O	UBA	ESRL	IMK-IFU		JMA
CFCs, HCFCs, HFCs		ESRL(SF_6)			JMA

towards WCC-SF6

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• 수소, 동위원소의 경우 MPI-BGC에서 CCL 지정 대기

A need for collaborations

- to organize the integrated network for Greenhouse Gases in East Asia.
- to share the data.
- to improve data quality by carrying out GHG Round-robin for other gases but for methane and to contribute WMO-GAW If possible by inviting more WCC .
- Finally overcome CC together by strengthen mutual cooperation by our collaboration

기상청 Korea Meteorological Administration

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Thank you for your attention .

감 사 합 니 다.