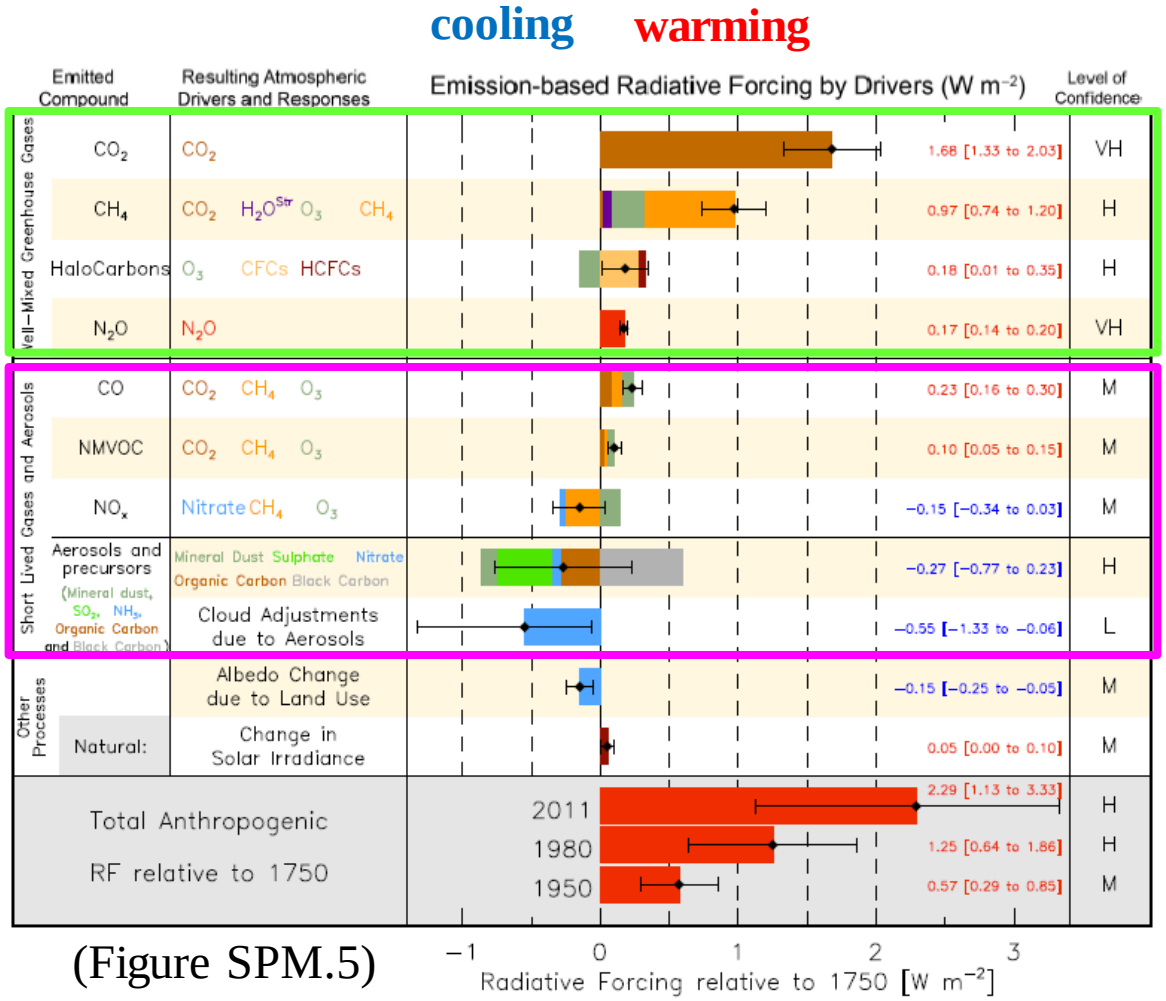
APMP Focus Group

Metrology for Climate Change

Chair: Jin Seog Kim (KRISS)

Co-Chair: Lin Hong (NIM)

Radiative Forcing for GHGs



(Figure SPM.5)

[Greenhouse Effect]

Radiative Forcing since 1750

- The total anthropogenic RF for 2011 relative to 1750 is 2.29 [1.13 to 3.33] W m^{-2}.
- RF of CO_2 is the largest, 1.82 [1.46 to 2.18] W m^{-2}.
- RF of aerosol is -0.9 [-1.9 to -0.1] W m^{-2}.

Net Flux of ambient CO2

[Tg CO_2 yr^{-1}]

Rank	Country	Fossil Fuel	Fire	Biosphere	Net Flux
1	UNITED STATES OF AMERICA	5794	97	-1627	4264
2	CHINA (MAINLAND)	5749	42	-761	5075
3	RUSSIAN FEDERATION	1589	455	-3745	-1701
4	INDIA	1478	46	13	1537
5	JAPAN	1265	0	-35	1230
6	GERMANY	797	0	-16	781
7	UNITED KINGDOM	555	0	-11	544
8	CANADA	554	150	-1330	-626
9	REPUBLIC OF KOREA	494	0	-10	484
10	ITALY	470	1	-12	459
11	ISLAMIC REPUBLIC OF IRAN	449	1	-17	433
12	MEXICO	443	29	-105	367
13	FRANCE	424	0	-34	390
14	SOUTH AFRICA	417	37	-42	412
15	SAUDI ARABIA	368	0	0	368
16	BRAZIL	362	791	-310	843
17	AUSTRALIA	354	448	-507	295
18	SPAIN	335	2	-6	331
19	INDONESIA	324	378	76	778
20	UKRAINE	318	8	-17	309

Working Group Members

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Terms of Reference (tentative)

- Scope
  - Metrology for the climate change in view of direct factors (calibration of instruments & sensors related to stack emission and background measurement)

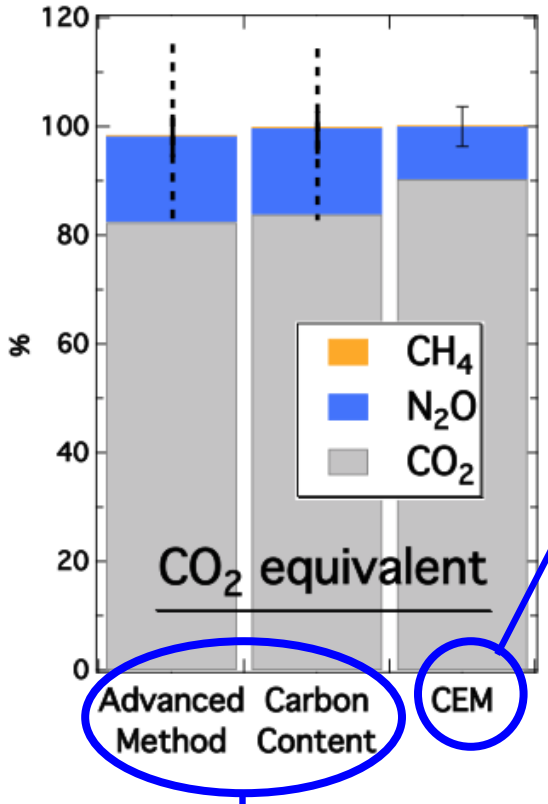
- Objectives
  - To establish national measurement standards related to the climate change (Flow, Temp, Sensor, spectroscopy, Gases, Aerosol)
  - To exchange information on how to support the national body of climate change by NMI (Measurable, Reportable, Verification)
  - To give the strategic advice to the NMIs on climate change programme

Certified Reference Materials * Key Comparison List for GHGs

Reference No.	Description	Coordinating Laboratory	Start date
CCQM-K1.b	CO_2 in N_2	VSL	1998
CCQM-K15	SF_6, CFCs - emission levels	KRISS	2003
CCQM-K52	CO_2 in air (360 - 400 ppm)	VSL	2006
CCQM-K68	N_2O at ambient levels	KRISS	2008
CCQM-K82	CH_4 in air	BIPM	2009
CCQM-K83	Halocarbons in air	NIST	2011
CCQM-K120	Ambient CO_2	BIPM/NIST	2016
APMP.QM-S4	CO_2 in N_2	KRISS	2011

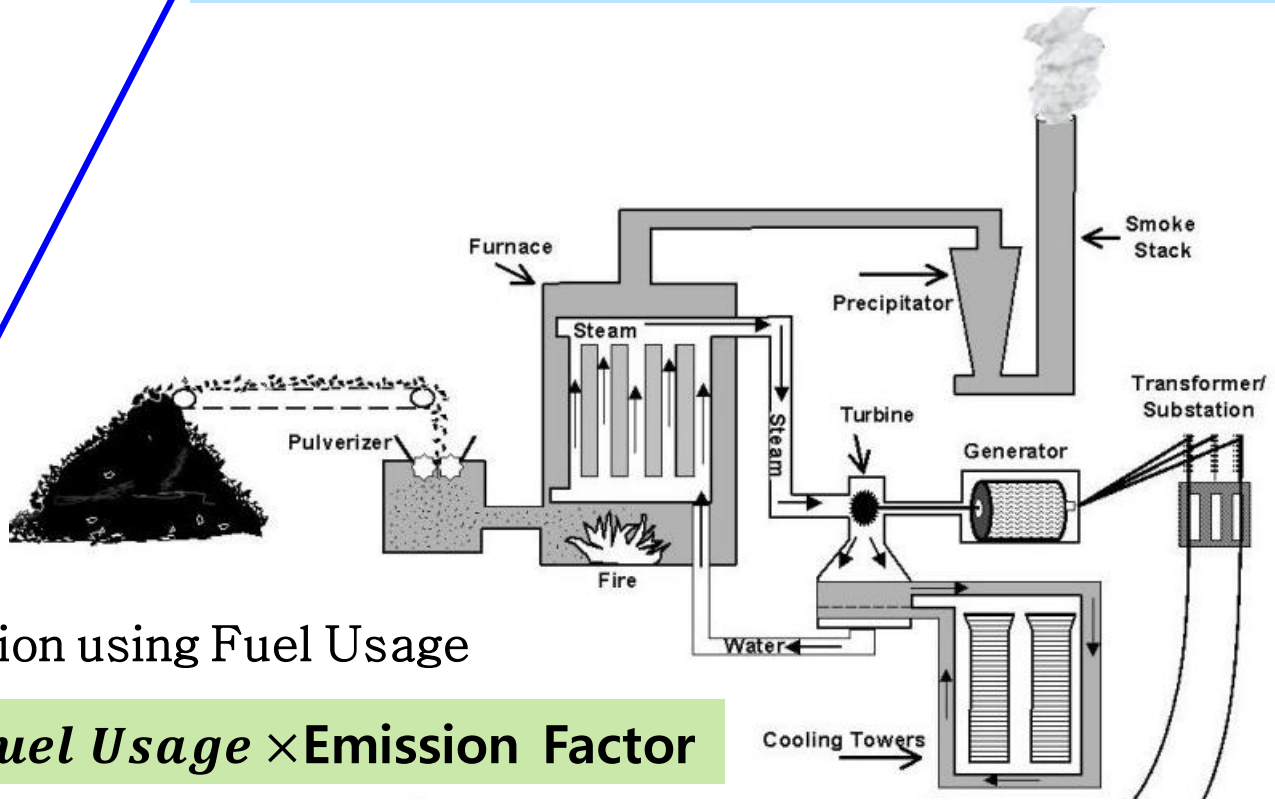
* Ambient level & Emission level from KRISS, NIM, NMIJ, (ITRI/CMS)

GHG Emission Measurement from Industry



Real time emission measurement

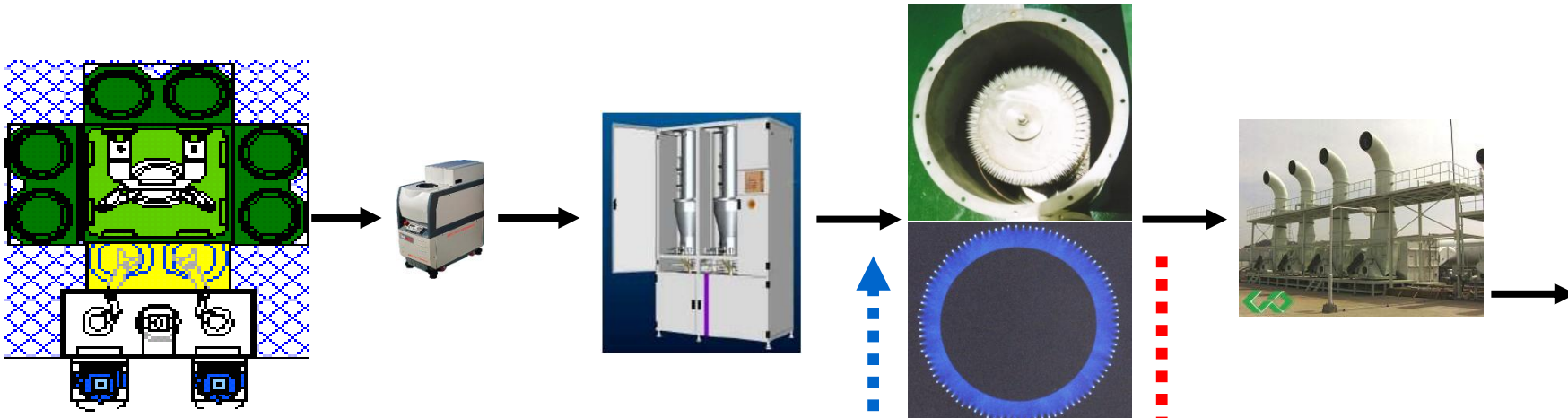
$$Emission = Concentration \times Flow\ rate$$



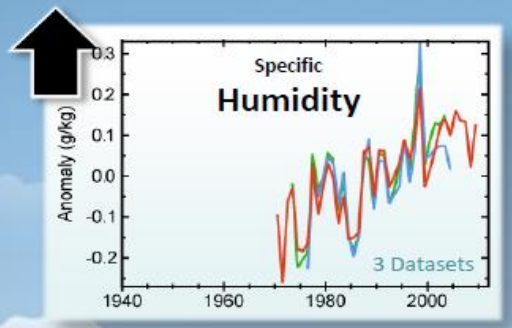
Emission Estimation using Fuel Usage

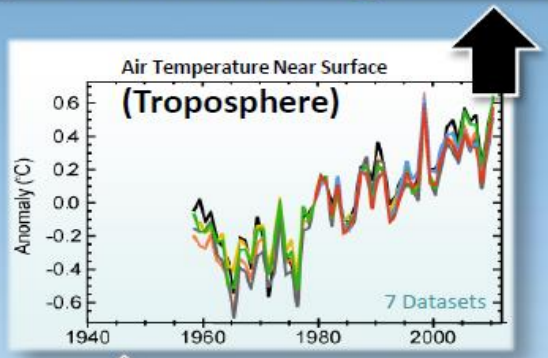
$$Emission = Fuel\ Usage \times \text{Emission Factor}$$

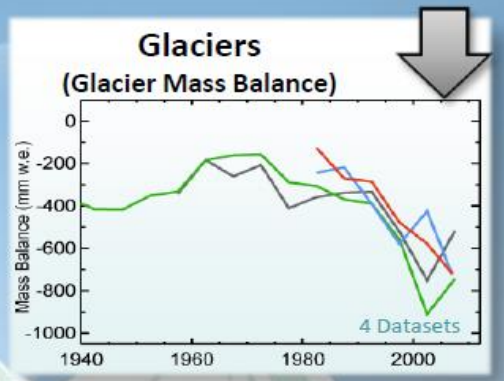
Emission Reduction of Greenhouse Gases by Industries under UN Framework Convention (Semiconductor & Display Company)

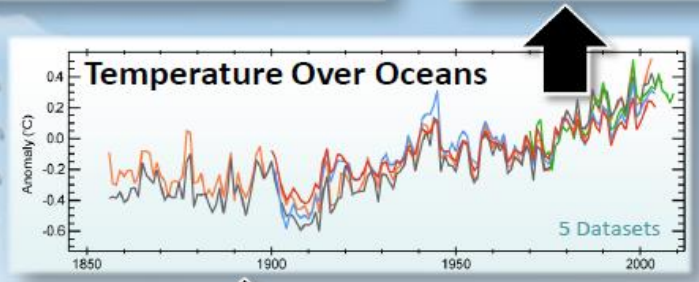


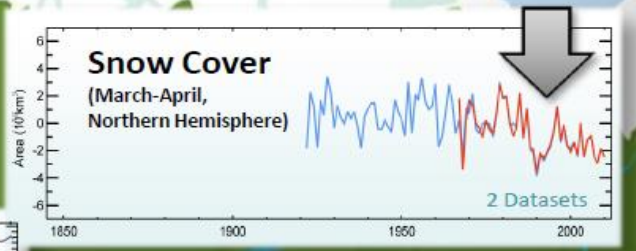
Observed Physical System by Climate Change

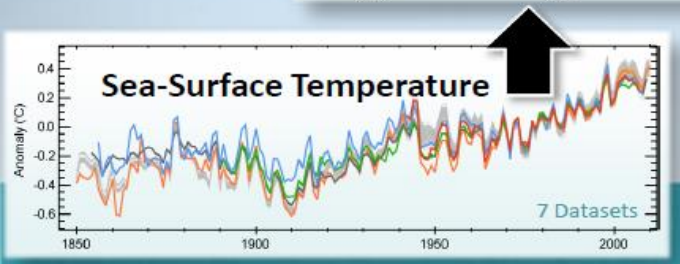


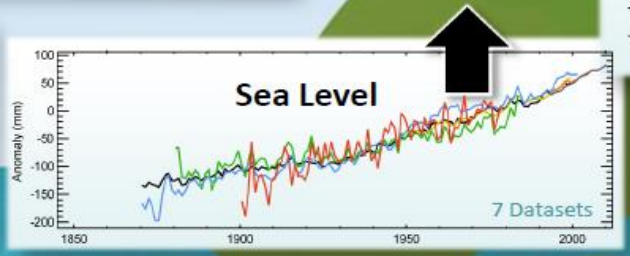


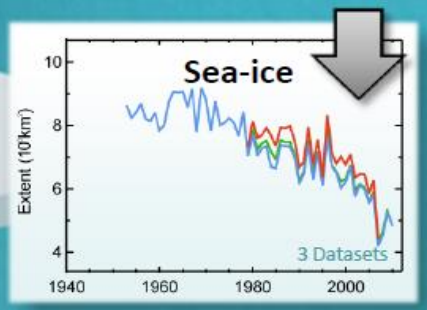


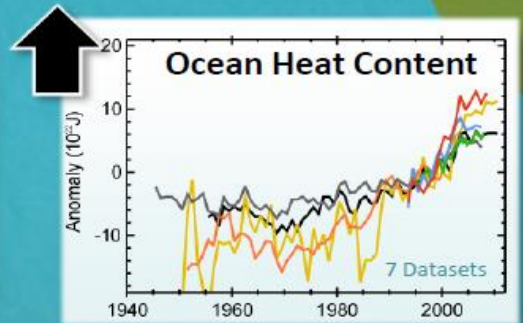


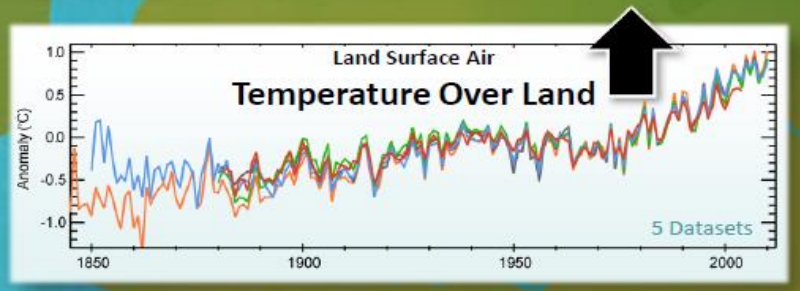












Credit: Roger Pulwarty (NOAA, ESRL), GCOS Workshop Obs & Adaptation, 26 Feb 2013

The Subjects in Climate Change FG

- CRM of GHGs: BG monitoring
  Flux meas. (forest, rice paddy)
  Emission measurement (Flow & Concentration)
  Removal & Destruction Efficiency
- Aerosol measurement (instruments & sensors)
- Remote monitoring (satellite, Lidar)
- Physical Measurement: Temp, Thermal conductivity

Work Plan for WG

- Organizing members (April 2015)
- Making the purpose of WG through e-mail, Gas Analysis WS, and ACRM meeting (Aug, 2015)
- Finding the situation of each NMIs (at this workshop)
  - to know national needs and capabilities
  - to check status of NMIs
- Develop action roadmap for 5 years
  - Progress report to APMP EC (May 2016)
- Organizing a workshop during APMP meeting (2016)