Developments in international key comparisons to support greenhouse gas monitoring and future requirements

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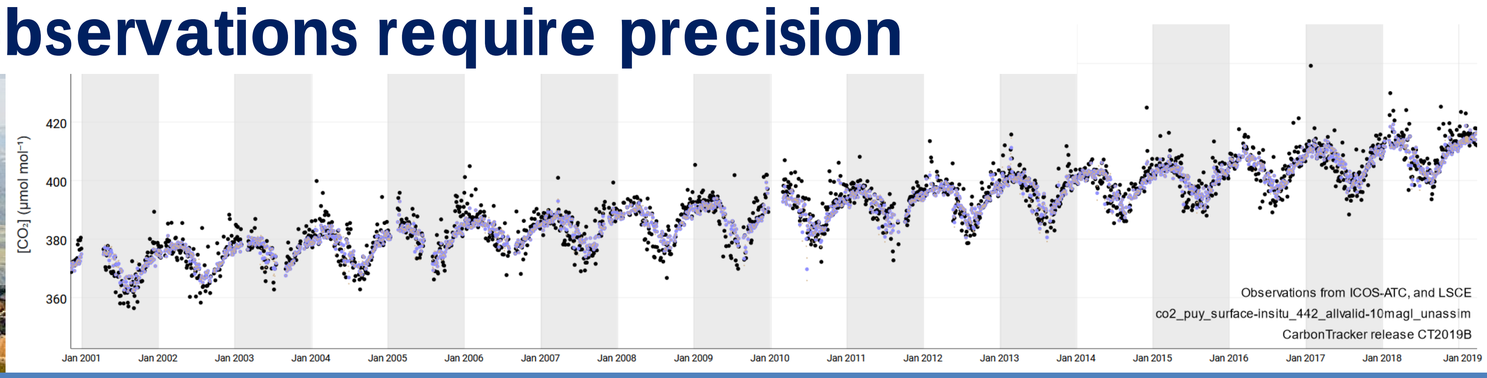
CO_2 (and other GHGs) observations require precision

- Compatibility goal 0.1 µmol/mol
- Standards internal consistency 0.01 µmol/mol
- Sufficient supply to meet demand

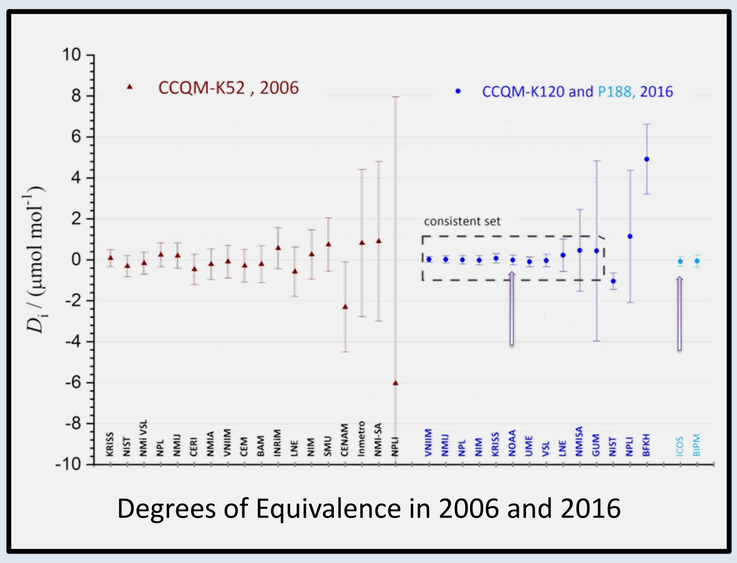


2019/02/08 05:00:
Observed: 415.7
Simulated: 414.38
Model Suite Minimum: 413.94
Model Suite Maximum: 414.82

Some data not plotted

Recent progress in CCQM-GAWG Key Comparisons

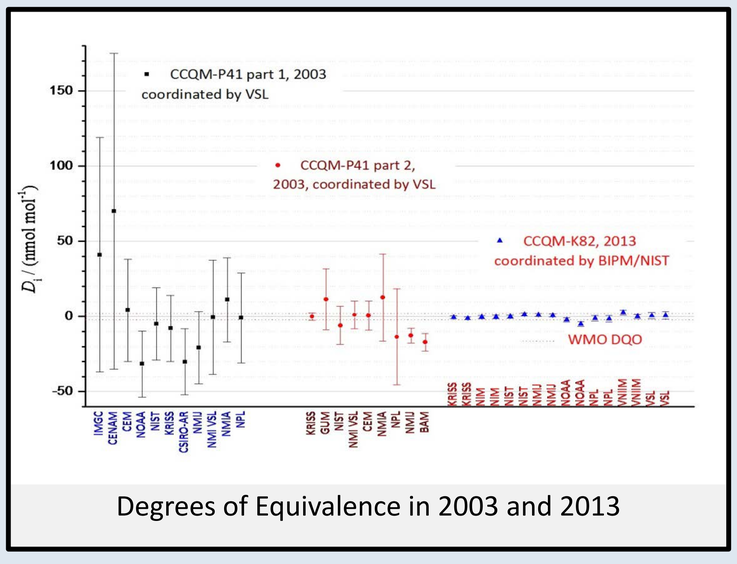
CO_2 in air (CCQM-K120)



Degrees of Equivalence in 2006 and 2016

WMO-CO2 scale maintained by NOAA and used by ICOS in good agreement with NMIs & uncertainties reduced between 2006 and 2016

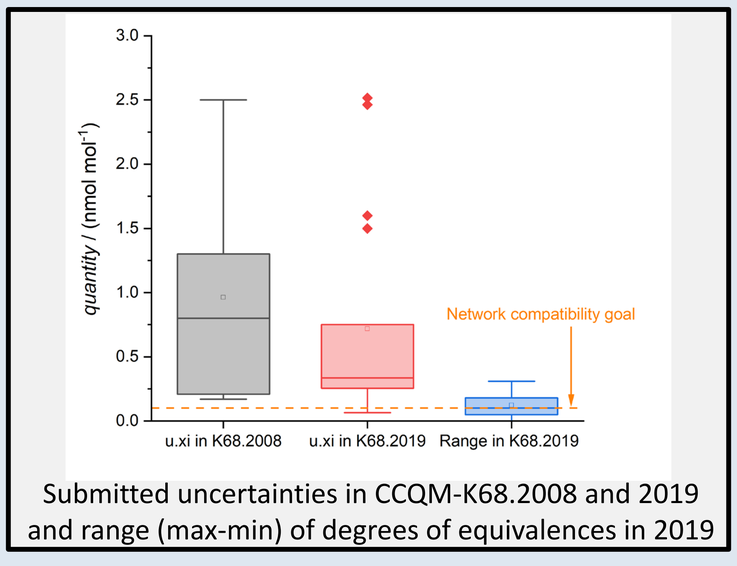
CH_4 in air (CCQM-K82)



Degrees of Equivalence in 2003 and 2013

Better agreement with WMO scale after change in 2006
NMIs uncertainties strongly reduced in 10 years
Next comparison in 2023

N_2O in air (CCQM-K68)



Submitted uncertainties in CCQM-K68.2008 and 2019 and range (max-min) of degrees of equivalences in 2019

Submitted uncertainties are large,
but agreement within pairs of standards for each lab reaches the compatibility goal

Challenges ahead

CO in air (CCQM-K84)

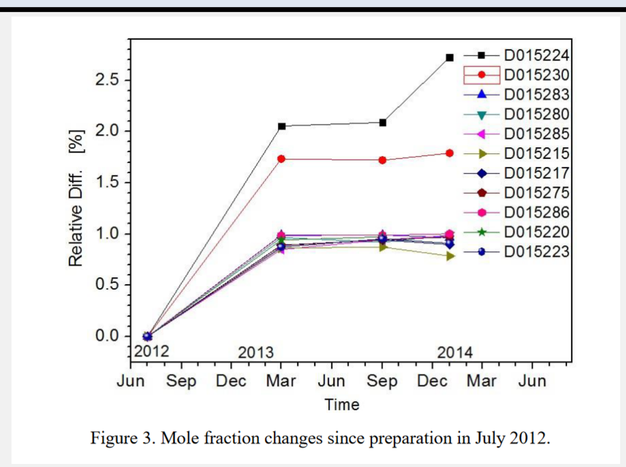
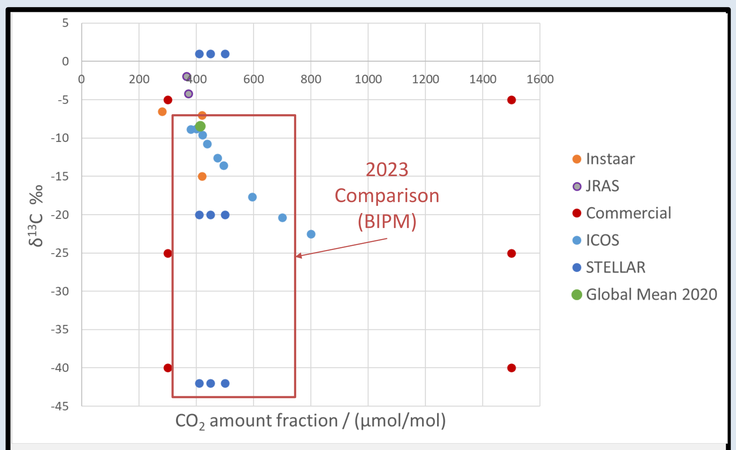


Figure 3. Mole fraction changes since preparation in July 2012.

Drifts in transfert standards of the comparison

Carbon monoxide is unstable in an air matrix
The unstability uncertainty impacts equivalence between comparisons' participants

CO_2 in air isotopes



CO_2 amount fraction vs. ^{13}C isotope delta value in air

CO_2 in air standards for measurements of $\delta^{13}C$ in air are not yet fully defined – A Pilot Study will take place in 2023 to compare existing reference materials

Scales comparisons

BIPM laboratory for BIPM.QM-K5

Two sets of 9 CO_2 in air standards prepared by ICOS Calibration Lab = 2 scales
+ 1 comparator = QCLAS CO_2 analyser

BIPM will organize an on-demand comparison of CO_2 in air scales maintained by WMO-CCL, NMIs and other expert laboratories - protocol being written within CCQM-GAWG-Task Group on GHGs

Coordination within CCQM-GAWG Task Group on GHG scales comparisons

CCQM-GAWG Task Group on GHG Scale Comparisons (CCQM-GAWG-TG-GHG)

Chair

Ms Jennifer Carney
National Institute of Standards and Technology
United States of America

Secretary

Dr Edgar Flores Jardines
Bureau international des poids et mesures
France

CCQM-GAWG

Task Group Mission

- ❑ How to establish a scale
- ❑ How to compare different scales
- ❑ Best practices to minimise uncertainties
- ❑ Setup on-going comparisons at BIPM

Task Team 1 – CO2 in Air Scale Establishment and Use

Chair: Kimberly Harris – NIST
Co-Chair: Bradley Hall – NOAA
Members:

Edgar Flores – BIPM	Olivier Laurent – LSCE	*ICOS*
Kai Fuu Ming – ASTAR	Dave Worton – NPL	*NIES*
Ralph Keeling – SIO	Jinsang Jung – KRISS	*Scripps*
Volker Ebert – PTB	Nibuyuki Aoki - AIST	
Jorge Koelliker – CENAM	Minami Amano - AIST	
Ian Chubchenko – VNIIM	Robert Wielgosz - BIPM	
Axel Fouqueau - LNE		

Task Team 2 – CO2 in Air Relationships, Comparisons and Databases

Chair: Andrew Crotwell - NOAA
Co-Chair: Joële Viallon - BIPM
Members:

Sangil Lee – KRISS	Paul Krummel - CSIRO
Adriaan van der Veen - VSL	Motoki Sasakawa - NIES
Paul Brewer - NPL	Tobias Buehlmann - METAS
Mudalo Jozela – NMISA	
Michela Sega - INRIM	
Ray Weiss – SIO	
Armin Jordan – MPI/ICOS	

See poster "Quantifying relationships between independent CO2 scales over decadal time scales" by Mr. Andrew Crotwell (T2-A5)