Quantifying relationships between independent CO_2 scales over decadal time scales

WMO GAW calibration strategy

- Goal: eliminate bias between monitoring networks
- Network compatibility goal 0.1 µmol/mol for CO_2
- Single reference scale recommended
- NOAA hosts CCL for CO_2 – WMO.CO2.X2019

Authors

Members of the CCQM-GAWG-TG-GHG- Team 2
on greenhouse gas scales comparisons as listed at the bottom

Acknowledgments

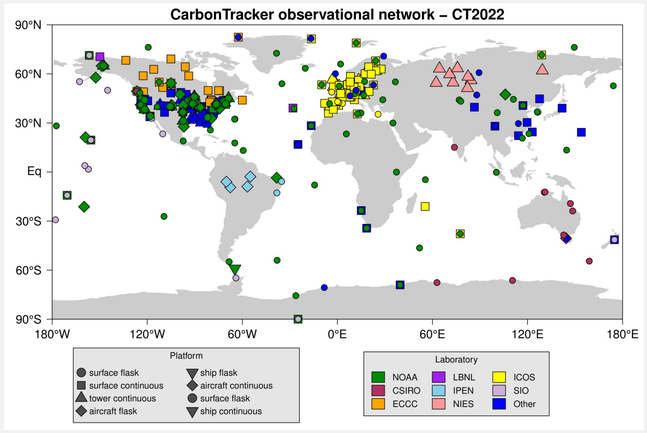
We would like to thank our respective institutions for support of this effort. We would also like to thank Ralph Keeling and the members of the CO_2 program at the Scripps Institution of Oceanography for allowing the use of the NOAA / SIO comparison data to help develop this protocol.

Limitations & risks

- Vulnerable to problems in the scale
- Availability of standards
  – how to respond to an expected increase in demand?

Rational for an on-going scales comparison

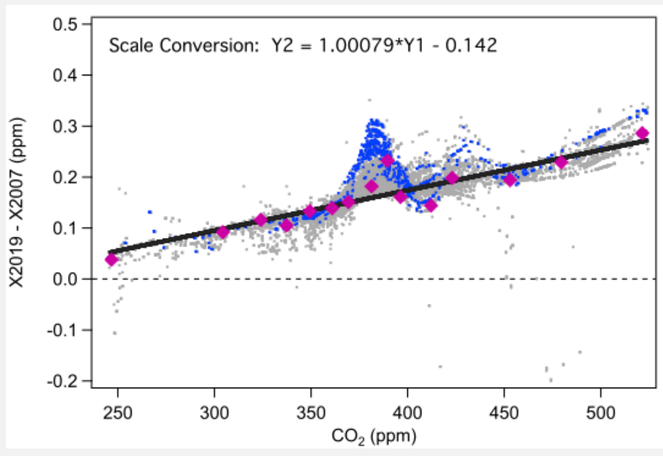
Network compatibility



Monitoring networks included in CarbonTracker

Many observational networks already exist, most are traceable to the WMO scale. Atmospheric data traceable to independent scales increases the robustness of findings but scale relationships are required for merging independent data in models.

Long term stability



Difference between WMO X2019 and X2007 scales for CO_2 amount fractions

Maintaining a CO_2 scale over decades is difficult but is required for long-term atmospheric monitoring applications. Comparison with independent scales is essential to identify problems.

Uses

- Converting atmospheric data to a common scale for interpretation
- Sourcing standards from multiple laboratories
- Evaluate long-term scale stability

Publication

- Visible to diverse user community
- Versioned to preserve transparency
- FAIR data principles

Findable Accessible Interoperable Reusable

Scales comparison strategy

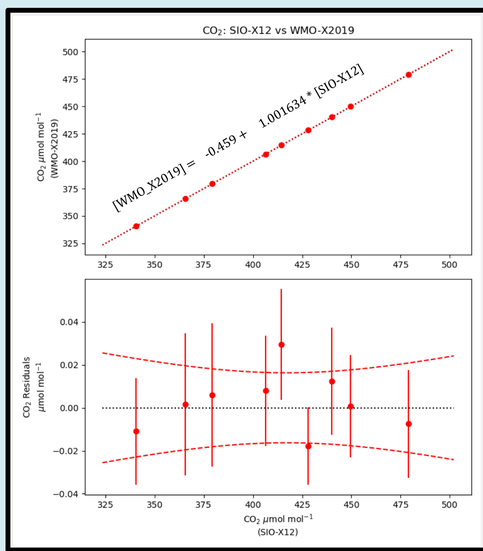
One central facility

BIPM laboratory for BIPM.QM-K5

Two sets of 9 CO_2 in air standards prepared by ICOS Calibration Lab = Reference scale and backup
Comparator = QC-TILDAS CO_2 analyser

Participants in the on-going comparison will submit sets of cylinders to BIPM, preferably in natural air matrix. Comparison covers range 380 to 800 µmol/mol

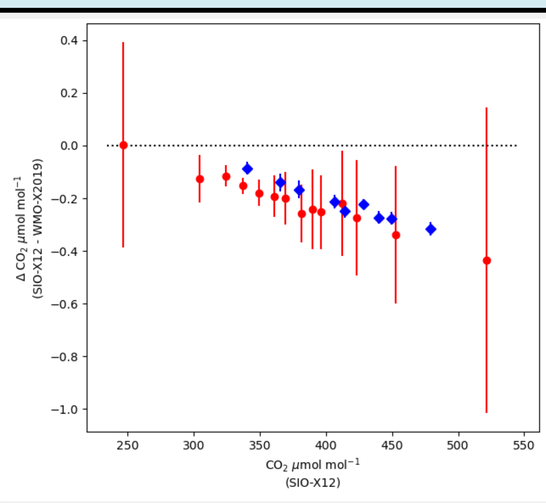
Data treatment



Example of relation between SIO-X12 and WMO-X2019

Desired result: mathematical relationships between each scale and BIPM with defined uncertainty;
Allows conversion between any scale

Frequency of comparisons



SIO-X12 vs WMO-X2019 in 1992-1999 and in 2020

The frequency needs to capture changes and assess long term stability of scale implementations.
SIO / WMO relationship shows some consistency over 25 years interval, but a period of 2-3 years is recommended.

CCQM-GAWG Task Group on GHG scales comparisons – Team 2

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

Chair

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United States of America

Secretary

Dr Edgar Flores Jardines
Bureau international des poids et mesures
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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

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