Evaluating CarboEurope/IMECC-quality control activities

Do intercomparison results help us to further improve our measurements?

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intercomparison activities

Sausage flasks: monthly since 2002; 8 long-term partners.
Grapefruit flasks: bimonthly since 2002; 4 long-term partners.
Cucumber cylinders: restart 2007; 32 participants.
Loflo ICP: start 2007; 3-4 times/yr; LSCE/CSIRO.
CO₂ comparability of "Cucumber" results
CO₂ comparability of "Sausage" results
CO$_2$ comparability of "Grapefruit" results

**CO2 Grapefruit Flask Intercomparison**

- **LSCE**
- **UHei**
- **CIO**

*September 3, 2009*
CO$_2$ comparability of high pressure cylinders
CMAR , LSCE, MPI

very stable offsets - adequate to apply correction term?
CO$_2$ comparability of flasks
CMAR, LSCE, MPI

flask ICP offsets less constant

different systems involved: GC$_{\text{MPI}}$ - Loflo$_{\text{MPI}}$ = 0.037 ppm
→ ICPs show only agreement of the very systems that are compared
CO$_2$ comparability of high pressure cylinders

UHEI, MPI

![Graph showing CO$_2$ comparability of high pressure cylinders between UHEI and MPI over time. The x-axis represents analysis time from Sep 2005 to Jul 2009, and the y-axis represents UHEI - MPI in ppm.]
CO$_2$ comparability UHEI-MPI: Cucumber, Sausages, Grapefruits

Discrepancy in Sausage/Grapefruit-Offsets:
Sausage-Grapefruit = 0.1 ppm
Have we improved over the recent years?
## Annual mean CO\textsubscript{2} offsets (vs MPI)

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CO$_2$ conclusions

what do the intercomparison data tell us?

- ICP results reflect the comparability of individual systems at different labs
- allow to identify systematic deviations including calibration
- participation of many labs enables diagnose for problems at single sites
- small inconsistencies in different ICPs help to spot analytical issues that might have been missed otherwise

where are we?

- not too bad for CO$_2$
- comparability stable, but not improving
- disclosed CO$_2$ measurement offsets have motivated to look after scales
How about non-CO$_2$ gases?
$\text{N}_2\text{O}$ comparability of "Cucumber" results
N$_2$O comparability: non-WMO calibration scales

-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

275 280 285 290 295 300 305 310 315 320 325

N$_2$O [ppb]

Lab X - MPI [ppb]

NIES
CMAR
N$_2$O comparability: WMO calibration scale

![N$_2$O comparability graph](image-url)
N$_2$O comparability: WMO calibration scale

![Graph showing N$_2$O comparability over time]
instrumental precision major limitation for N₂O comparability
CO comparability of "Sausage" results
CO: various independent calibration scales

![Graph showing CO concentration in ppb vs. difference in Lab X-MPI/ppb for UHEI, NIES, and CMAR]
CO: scales

![Graph showing CO vs difference NIES - MPI (ppb)]
CO: NOAA calibration scales
CO: influence of instrument linearity

![Graph showing the relationship between CO and NOAA-MPI ppb values. The x-axis represents CO in ppb, ranging from 100 to 550. The y-axis represents NOAA-MPI ppb, ranging from -40 to 5. The data points show a decreasing trend as CO increases.]
CO: influence of instrument linearity

![Graph showing CO concentrations for NOAA-MPI and various sources like Sausage RGA, Sausage VUV, and cucumber VUV. The x-axis represents CO concentrations in ppb, ranging from 100 to 550, and the y-axis represents the difference in ppb between NOAA-MPI and each source. The graph shows a trend where the difference decreases as CO concentration increases.]
Conclusions

where are we we?
• comparability of N₂O, CO, H₂ much worse than for CO₂ or CH₄
• other tracers did not receive that much focus in consequence look worse

do we know the limiting factors?
• N₂O: instrumental performance, calibration scale
• CO: instrument non-linearities, calibration scale, standard drifts
• single ICP point in time cannot represent the comparability over longer periods of time

what would improve the usefulness of the ICP
• more rigid flagging
• additional meta data information
  e.g. calibration range, working standard changes
Final remarks

1. ICP results only help if they are paid attention to
2. ICP results will only be taken notice of if they are updated regularly
3. ICP results can be updated regularly only if data is made available in the accepted format

Thanks to all who contribute to this common effort!