Action P4: Instrumentation Quality Insurance

Contributors: BUW (action leader), CNRS-IRCELYON (Lyon), CNRS-ICARE (Orléans), TROPOS (Leipzig), BRRC (Brussels), CTG (Bergamo), LISA (Paris)

Main Objectives:

- Definition of instruments to be used in the field campaigns (lab, tunnel, street canyon).
- Verification of instruments' quality (accuracy, precision, detection limit, interferences).
- Intercomparison of duplicate instruments in the field campaigns (see action I1 and I2).

Some Results:

Definition of the instruments

Since the photochemistry of the atmosphere and the subsequent formation of harmful photo-oxidants, like ozone (O_3), is controlled by the abundance of VOCs and reactive nitrogen oxides (NO_y: NO, NO_2, HONO, etc.), and since both groups of trace gases show also direct negative health effects (for example: NO_2, HONO, aldehydes, aromatics,...), the instrumentation was focused on these harmful trace gases.

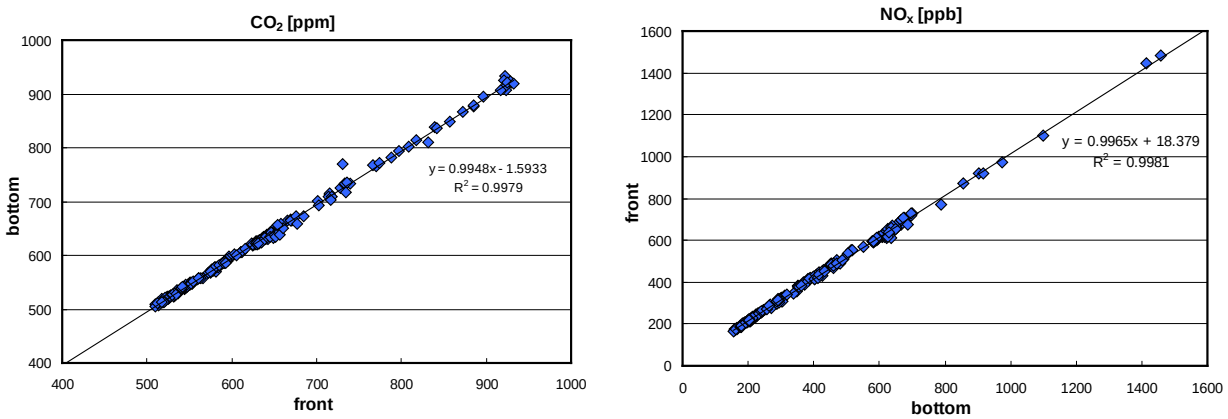
Quality Insurance

Most instruments used in PhotoPaq were carefully calibrated, different calibration standards were exchanged between the partners and interferences were also studied in the laboratory. In addition, some instruments were also intercalibrated in other international projects. For example, in the FIONA project [1] the HONO instruments used in PhotoPaq were successfully intercalibrated in the EUPHORE smog chamber against 18 other HONO instruments used world-wide for the detection of HONO.

Intercalibration during the Implementation Actions (I1, I2)

During all field campaigns the duplicate instruments were intercalibrated at a single site (same air mass) for one day. This is an important task to ensure that differences, later observed when the instruments were separated to the two sites in each implementation action (active + reference site, see actions I1/I2), are caused the photo-catalytic activity of the materials under investigation.

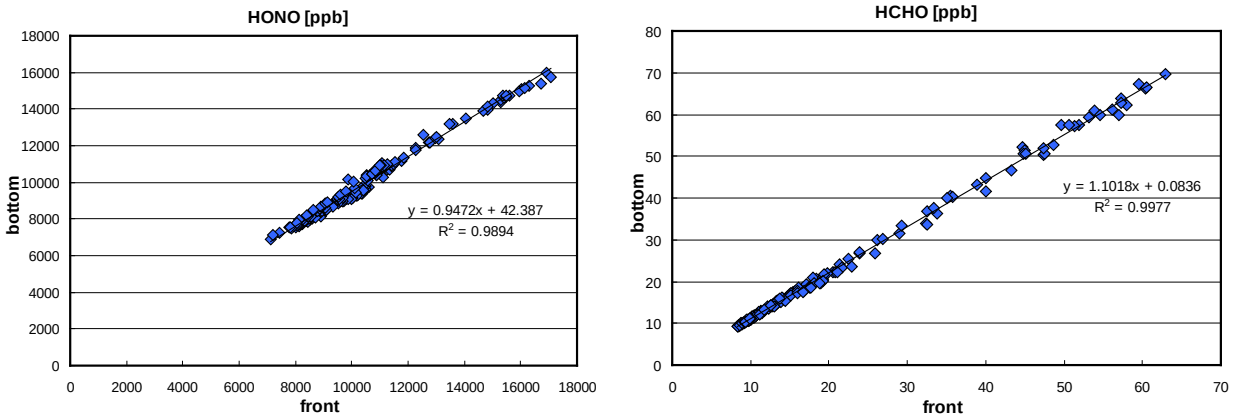
For most conditions, excellent agreement was observed, see figures below. In this case, the original data was directly used to quantify the photo-catalytic remediation.



Successful intercalibration of two CO_2 and NO_x instruments during the I2 tunnel campaign in January 2013 in the Leopold II tunnel in Brussels, Belgium. Here the slopes of the correlation plots are close to one (both instruments measure the same).

In contrast, for other species, significant deviations between the duplicate instruments were observed during the intercalibrations, see the figures below. Here, the experimental data were harmonized to obtain a higher precision in the concentration differences between the two sites used to quantify the photo-catalytic remediation in the I1 and I2 actions.

Caused by this procedure, detection limits for the photo-catalytic remediation of ±2 and ±5 % were estimated for the field campaigns in the tunnel and street canyon, respectively.



Intercalibration of two HONO and HCHO instruments during the I2 tunnel campaign in January 2013 in the Leopold II tunnel in Brussels, Belgium. For the two species shown, the slopes of the correlation plots were different to one, i.e. one instrument was later harmonized (HONO: 5.3 %, HCHO: 10.2 %) to ensure high precision of the photo-catalytic remediation results.

References

[1] http://euphore.es/fiona/fiona.html.