Sites

AUC_2024_WS

CMN2024_ws.pdf

CVO2024_WS.pdf

HPB2024_WS.pdf

KOS2024_WS.pdf

PDD2024_WS.pdf

SIRTA2024_WS.pdf

Nox Data Submission

NOx implementation of ACTRIS In Situ data levels:

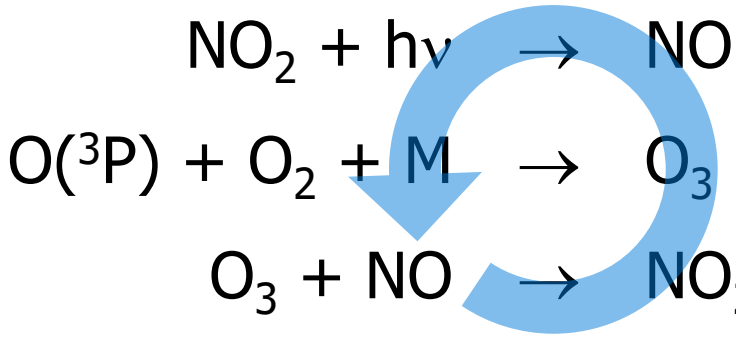
Level 0a: data as provided by instrument, amount fraction and raw counts, flags applied.

Level 1a: calibrations applied, original time resolution, flags applied.

Level 2: hourly averages, offset correction applied, not sample line corrected.

Level 3: generated directly from level 1, offset correction applied, hourly averages, sample line corrected.

Chemistry in the inlet



$$NO_2 + h\nu \rightarrow NO + O(^3P) \qquad j_{5.1}$$

$$O(^3P) + O_2 + M \rightarrow O_3 + M \qquad k_{5.2}$$

$$O_3 + NO \rightarrow NO_2 + O_2 \qquad k_{5.3}$$

$$NO_2 \overset{h\nu}{\rightleftharpoons} NO + O_3$$

Humidity effects

$NO + O_3 \rightarrow NO_2 + O_2$

$NO + O_3 \rightarrow NO_2^* + O_2$

$NO_2^* \rightarrow NO_2 + h \cdot \nu$

$NO_2^* + M \rightarrow NO_2$, $M = N_2, O_2, H_2O, Ar$

Matthews, R. D., Sawyer, R. F., & Schefer, R. W. (1977). Interferences in chemiluminescent measurement of nitric oxide and nitrogen dioxide emissions from combustion systems. *Environmental Science & Technology, 11*(12), 1092-1096. doi:10.1021/es60135a005

$NO_2^* + N_2 \rightarrow NO_2$	$k(NO_2^*+N_2)$
$NO_2^* + O_2 \rightarrow NO_2$	$k(NO_2^*+N_2)*1.115$
$NO_2^* + CO_2 \rightarrow NO_2$	$k(NO_2^*+N_2)*2.05$
$NO_2^* + Ar \rightarrow NO_2$	$k(NO_2^*+N_2)*0.5$
$NO_2^* + H_2O \rightarrow NO_2$	$k(NO_2^*+N_2)*4.42$

Factor for quenching in ambient air

21%	1.034
400ppm	1.000
1%	0.995
1%	1.043

Consequences (for CLD instruments)

- 0-10% correction needed for calibrations using NO/N_2 diluted by synth. air
- This is done with measured meteorological parameters

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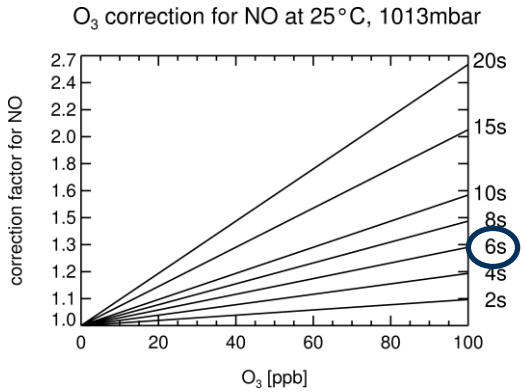
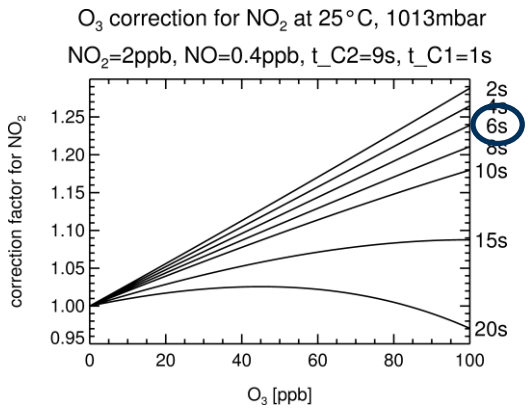
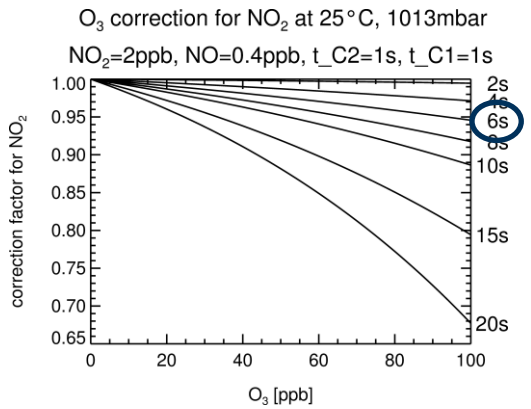
Chemistry in the inlet







Accepted by EEA

correction factor for NO

correction factor for NO_2, long residence time in converter

correction factor for NO_2, short residence time in converter

NO is underestimated

NO_2 is underestimated or overestimated (depending on O_3, NO and converter)

Inlet line correction is needed for **ALL NOx instruments**

Interference can be corrected for, if ozone is measured

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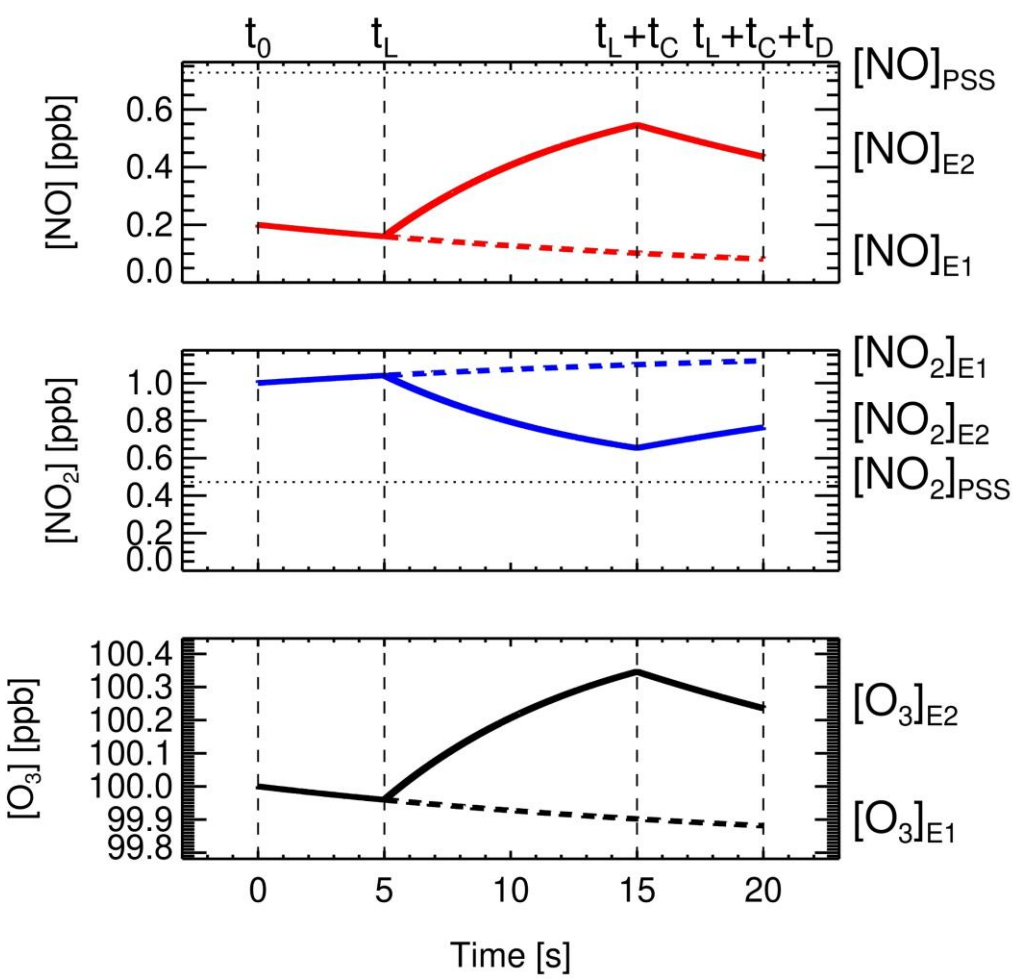
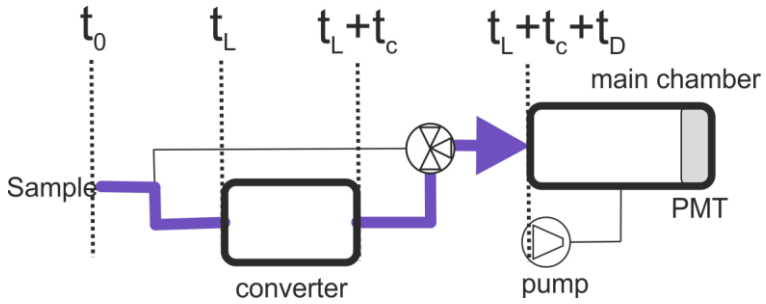
Chemistry in the inlet





$$[\mathrm{NO}]_0 = [\mathrm{NO}]_{\mathrm{E1}} \times e^{k_{O_3 L} \times (t_L + t_B + t_D)}$$

$$NO_2 \rightleftharpoons NO + O_3$$

See:
https://ebas-submit.nilu.no/SOPs
Or:

Andersen, S. T., et al. (2021). "Long-term NOx measurements in the remote marine tropical troposphere." Atmos. Meas. Tech. **14**(4): 3071-3085.

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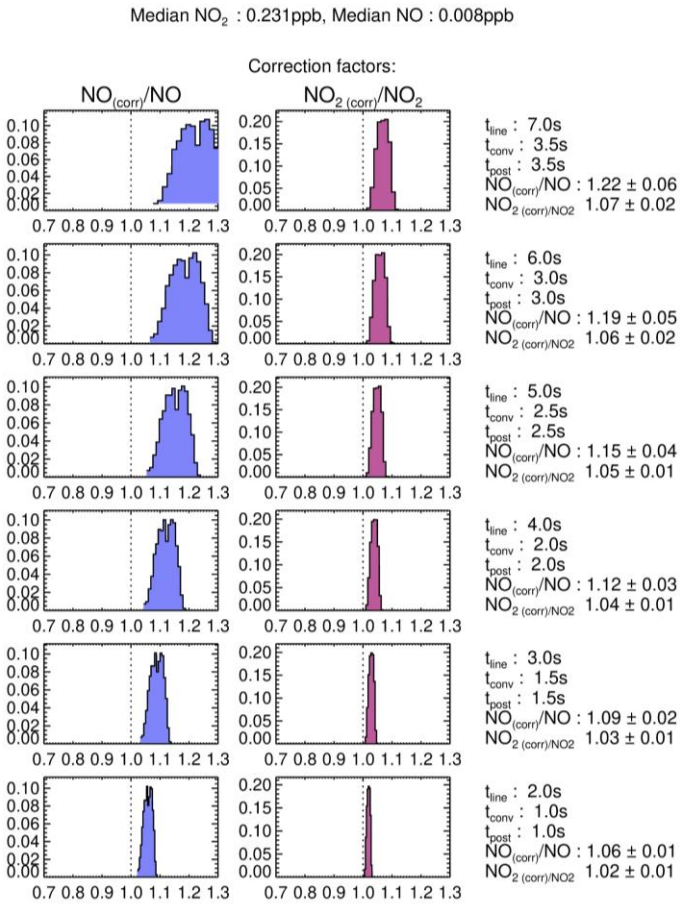
Chemistry in the inlet – How large is the effect ?



ACTRIS Site Pallas,
different residence times

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Objectives

Converter

Processes in the Sampling Line

Humidity effects

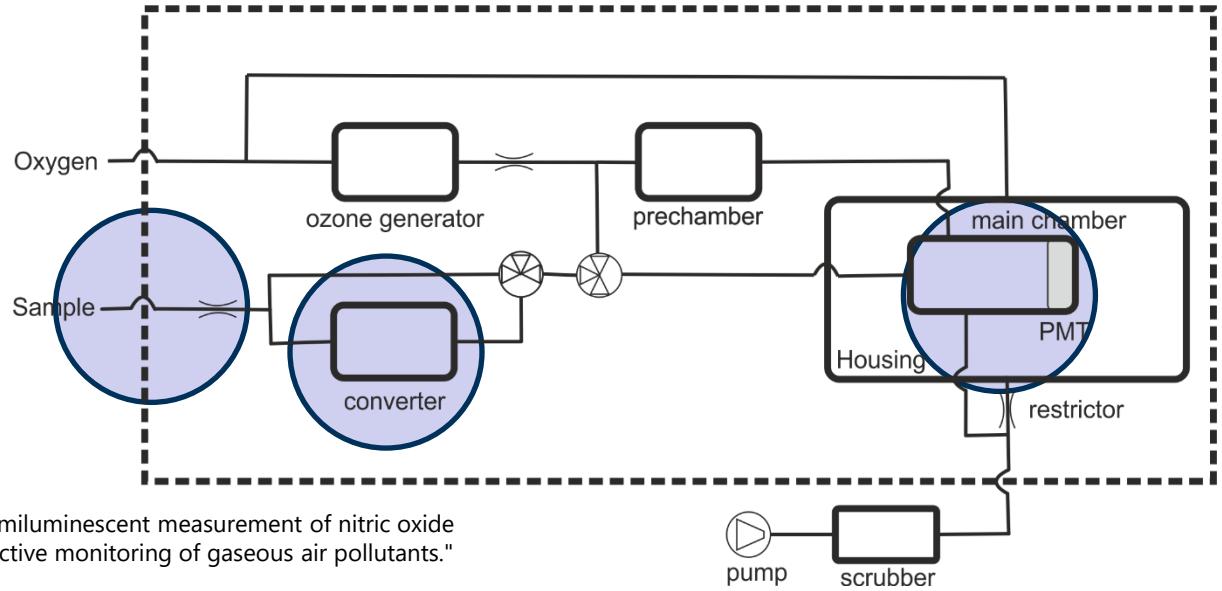
$$NO + O_3 \rightarrow NO_2 + O_2$$

$$NO + O_3 \rightarrow NO_2^* + O_2$$

$$NO_2^* + M \rightarrow NO_2 \quad , M = N_2, O_2, H_2O, Ar$$

$$NO_2^* \rightarrow NO_2 + h\cdot\nu$$

$$(590 \leq \lambda \leq 3000 \text{ nm})$$



Fontijn, A., et al. (1970). "Homogeneous chemiluminescent measurement of nitric oxide with ozone. Implications for continuous selective monitoring of gaseous air pollutants." Analytical Chemistry **42**(6): 575-579.

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