Supplement of Atmos. Meas. Tech., 19, 4797–4813, 2026
https://doi.org/10.5194/amt-19-4797-2026-supplement

Supplement of

Five-channel TD-CEAS measurements of gaseous and particulate organic nitrates with NO / NO_2 interference correction under high-NO_x conditions

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S1 Details of NO and NO_2 interference correction experiment

The experimental setup for calibration is shown in Figure S2. A transparent FEP-Teflon bag (~16 L) was employed as a photochemical reactor. Acetone vapor, NO, and dry air were continuously introduced into the reactor under irradiation from a 285 nm UV lamp. Acetone vapor was generated by bubbling dry air at 2 mL min^{-1} through liquid acetone, with the resulting vapor carried into the reactor. NO (20–110 ppbv) was supplied by a Thermo Scientific 146i multi-gas calibrator using a certified NO standard (9.96 ppmv) diluted with dry air. The total flow rate into the reactor was maintained at 4.5 L min^{-1}, corresponding to a gas residence time of approximately 3.5 min. The effluent from the reactor was analyzed simultaneously by a TD-CEAS system for NO_2 and gΣPNs, a Thermo Scientific 42i-TL analyzer for NO, and a GC-ECD for PAN quantification. The calibration matrix covered NO/NO_2 ratios from 0.044 to 2.015, which spans the range used later for the PAN-based correction model. The PAN-source experiment should be regarded as a diagnostic test of inlet chemistry under controlled conditions rather than as a chemically complete representation of ambient mixed ΣPN/ΣAN composition.

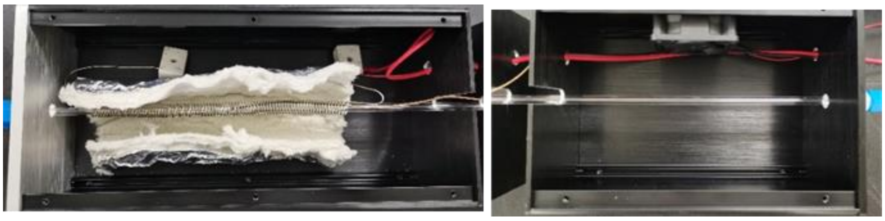

Figure S1 Photograph of TD inlet box.

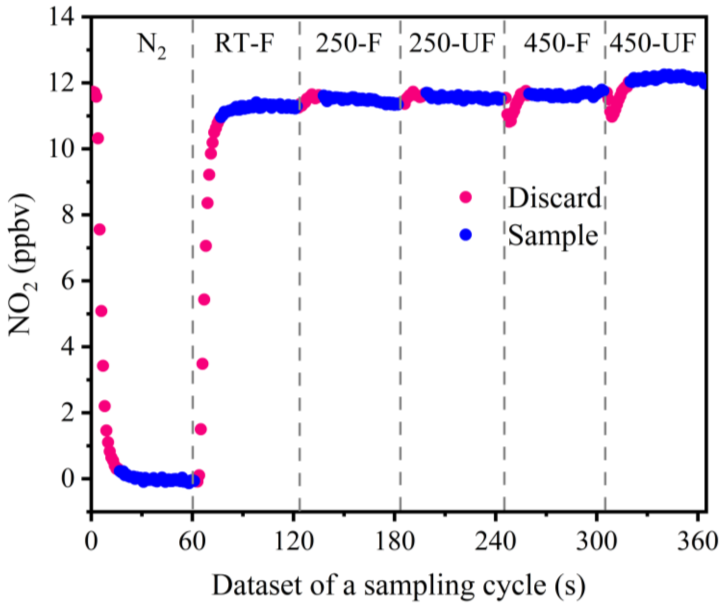

Figure S2 An example of a dataset during a sampling cycle. The red points represent data from the transition period following a channel switch, which is discarded during calculation. The blue points represent sample data.

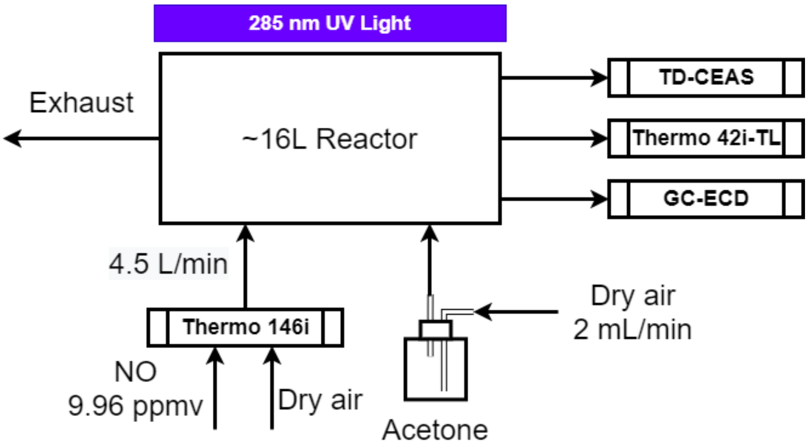

Figure S3 Schematic diagram of NO and NO_2 interference correction experiment.

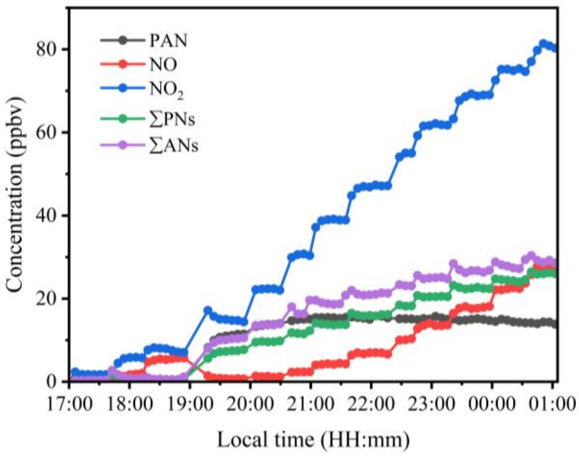

Figure S4 Measurements of PAN, NO, NO_2, ΣPNs and ΣANs when different NO concentrations are introduced into acetone/air gas under 285 nm UV lamp irradiation. ΣPNs is calculated as $[NO_2]_{250}$ — $[NO_2]_{RT}$, ΣANs is calculated as $[NO_2]_{450}$ —$[NO_2]_{RT}$.

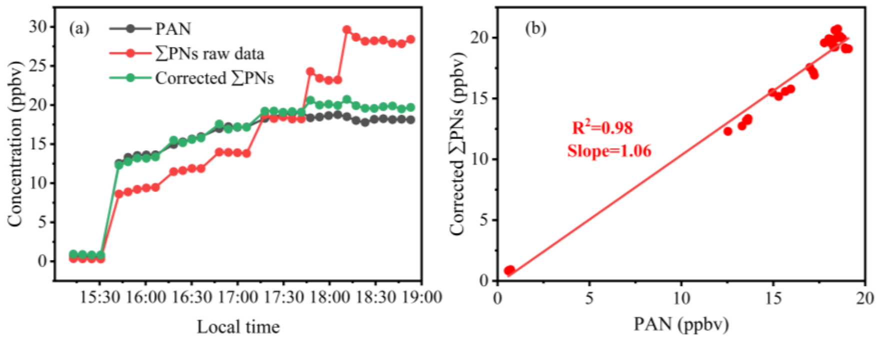

Figure S5 (a) Comparison of corrected ΣPNs with measured PAN and ΣPNs in the validation experiment; (b) Linear fitting of corrected ΣPNs and measured PAN in the validation experiment.

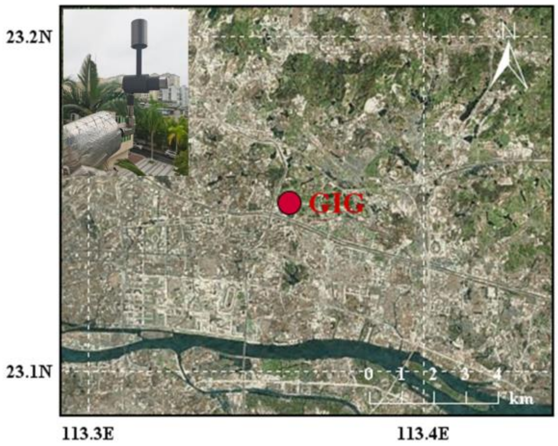

Figure S6 $PM_{2.5}$ sample inlet and sampling site location. The map was created using MeteoInfo (http://www.meteothink.org), an open-source software developed by Wang (2014).

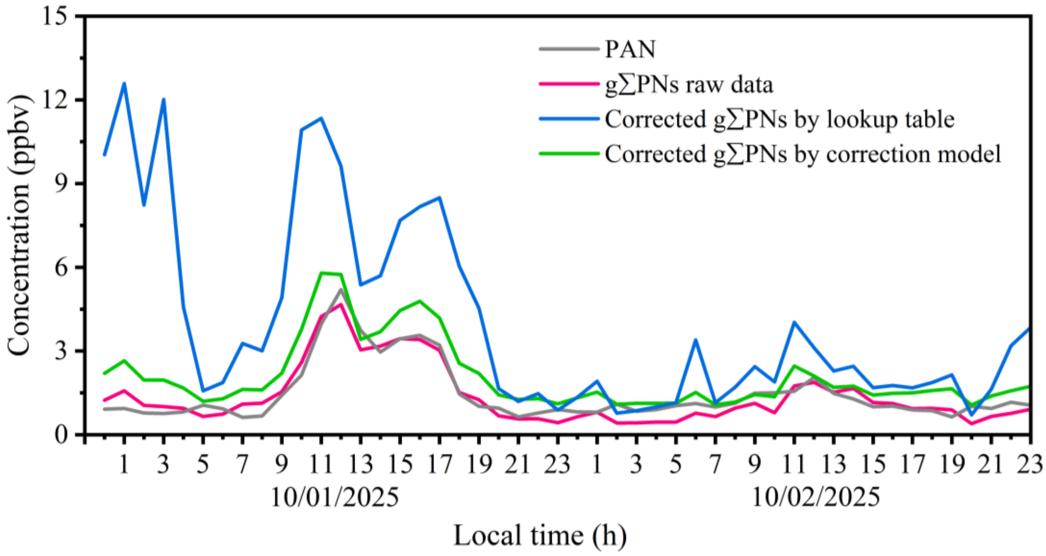

Figure S7 Comparison of gΣPNs raw data, measured PAN and correction results from two correction methods. The gray line represents PAN measured by GC-ECD, the red line shows raw gΣPNs measured by TD-CEAS, the green line indicates gΣPNs corrected by correction model, the blue line represents gΣPNs corrected by lookup table. The corrected gΣPNs values are operational, PAN-anchored estimates intended for daytime interpretation.

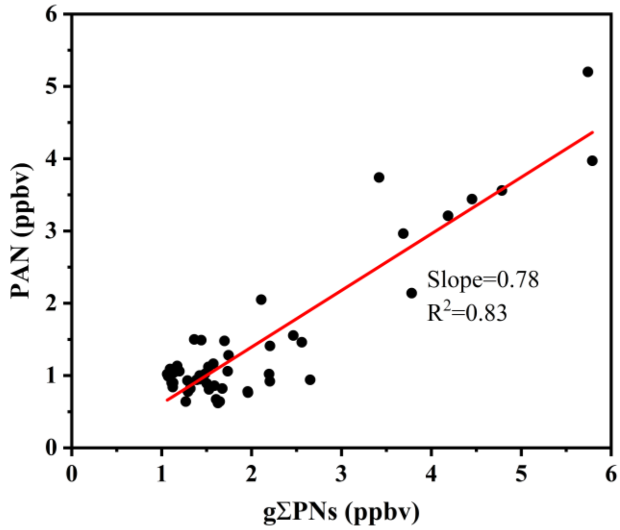

Figure S8 Linear fitting of gΣPNs and PAN during the observation in October 2025. Gas-phase ΣPNs (gΣPNs) were derived from the TD-CEAS signal by applying the developed correction model, while PAN were quantified using a GC-ECD. This comparison is used to evaluate the daytime performance of the corrected gas-phase ΣPN retrieval.

Table S1. Channel definitions and the corresponding quantities measured as NO_2 mixing ratios by CEAS.

Channel	**TD setpoint**	**Filter placement**	**What enters TD**	**CEAS measures**
RT-F	RT	upstream	gas only	NO_2
250-F	250 °C	upstream	gas only	NO_2 + gΣPNs → NO_2
450-F	450 °C	upstream	gas only	NO_2 + gΣPNs + gΣANs → NO_2
250-UF	250 °C	downstream	gas + particles	NO_2 + (g+p)ΣPNs → NO_2
450-UF	450 °C	downstream	gas + particles	NO_2 + (g+p)ΣPNs + (g+p)ΣANs → NO_2

Table S2 Comparison of correction-factor lookup-table and correction model evaluation metrics.

Indicators	Lookup table	Correction model (This study)
R^2	0.975	0.993
RMSE (ppbv)	25.011	0.493
RRSE (%)	411.6%	8.1%

References

Wang, Y. Q.: MeteoInfo: GIS software for meteorological data visualization and analysis, Meteorol. Appl., 21, 360-368, https://doi.org/10.1002/met.1345, 2014.