

SUPPLEMENTAL MATERIAL

Assessing the accuracy of commercially available gas sensors for the measurement of ambient ozone and nitrogen dioxide



Figure S1: Co-location of Sensors at a Monitoring Station. 1 = Aeroqual O₃ sensor; 2 = Aeroqual NO₂ Sensor; 3 = Cairclip O₃/NO₂ Sensor; 4 = Sampling Inlet of EPA reference Instruments: O_{3mon} [O₃ measured by a photometric O₃ analyzer], NO_{2mon} [NO₂ measured by a NO_x chemiluminescence analyzer], (O₃+NO₂)_{mon} [the sum of NO₂ and O₃ measured by a NO_x chemiluminescence analyzer and photometric O₃ analyzer, respectively].

Initial model for correcting the effect of T, RH and NO₂ on the performance of the Aeroqual O₃ sensor:

$$O_{3mon} = \beta_0 + \beta_1 \times \text{Aeroqual O}_3 \text{ Sensor} + \beta_2 \times \text{Aeroqual O}_3 \text{ Sensor}^2 + \beta_3 \times NO_{2mon} + \beta_4 \times NO_{2mon}^2 + \beta_5 \times T + \beta_6 \times T^2 + \beta_7 \times RH + \beta_8 \times RH^2 + \varepsilon \quad (\text{S1})$$

Initial model for correcting the effect of T, RH and O₃ on the performance of the Aeroqual NO₂ sensor:

$$NO_{2mon} = \beta_0 + \beta_1 \times \text{Aeroqual NO}_2 \text{ Sensor} + \beta_2 \times O_{3mon} + \beta_3 \times T + \beta_4 \times RH + \varepsilon \quad (\text{S2})$$

Initial model for correcting the effect of T and RH on the performance of the Cairclip O₃/NO₂ sensor:

$$(O_3 + NO_2)_{mon} = \beta_0 + \beta_1 \times \text{Cairclip } O_3/NO_2 \text{ Sensor} + \beta_2 \times T + \beta_3 \times RH + \varepsilon$$

(S3)

Where $O_{3\text{mon}}$ = O_3 measured by the EPA reference-equivalent instrument with a photometric O_3 analyzer (ppb), $NO_{2\text{mon}}$ = NO_2 measured by the EPA reference instrument with a NO_x chemiluminescence analyzer (ppb), $(O_3+NO_2)_{mon}$ = the sum of O_3 measured by the EPA reference instrument with a photometric O_3 analyzer and NO_2 measured by the EPA reference instrument with a NO_x chemiluminescence analyzer, T = temperature ($^{\circ}\text{C}$), RH = relative humidity (%) and ε = error term.

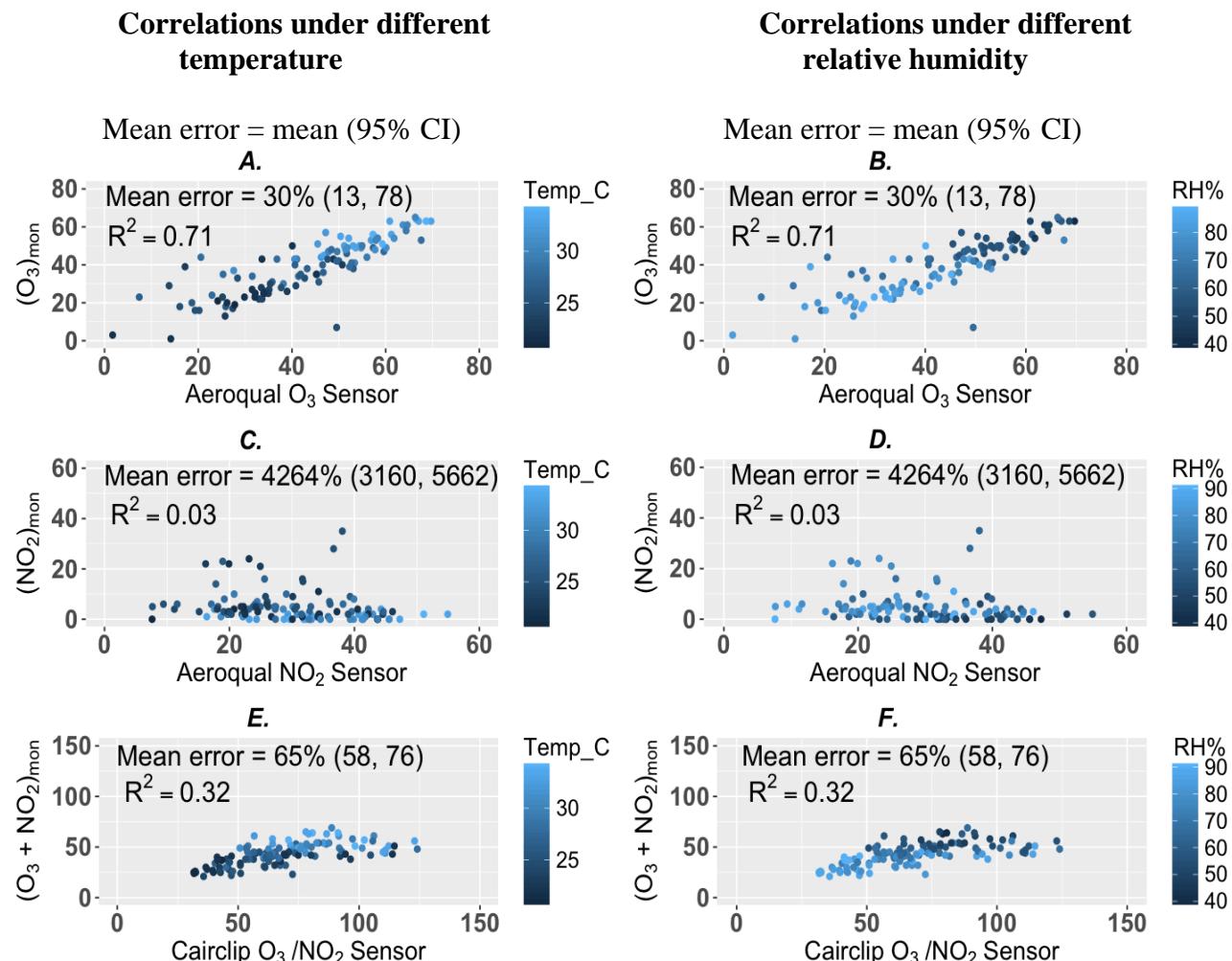


Figure S2: Correlation plots of raw sensor measurements and EPA monitoring instruments from the training dataset (first co-locating period). Units in ppb. Temp_C = temperature measured in degrees centigrade, RH% = relative humidity in percentage, R^2 = coefficient of determination based on linear regression, $(O_3)_{mon}$ = O_3 measured with a photometric O_3 analyzer, Aeroqual O_3

sensor = O_3 measured by the Aeroqual GSS O_3 sensor, $(NO_2)_{mon}$ = NO_2 measured with a NOx chemiluminescence analyzer, Aeroqual NO_2 sensor = NO_2 measured by the Aeroqual GSS NO_2 sensor, $(O_3 + NO_2)_{mon}$ = the sum of O_3 and NO_2 measured by NOx chemiluminescence and photometric O_3 analyzers, respectively, Cairclip O_3/NO_2 sensor = O_3+NO_2 measured by the Cairclip O_3/NO_2 sensor ($n = 107$ in Figures A and B; $n = 120$ in Figures C and D and $n = 120$ in Figures E and F).

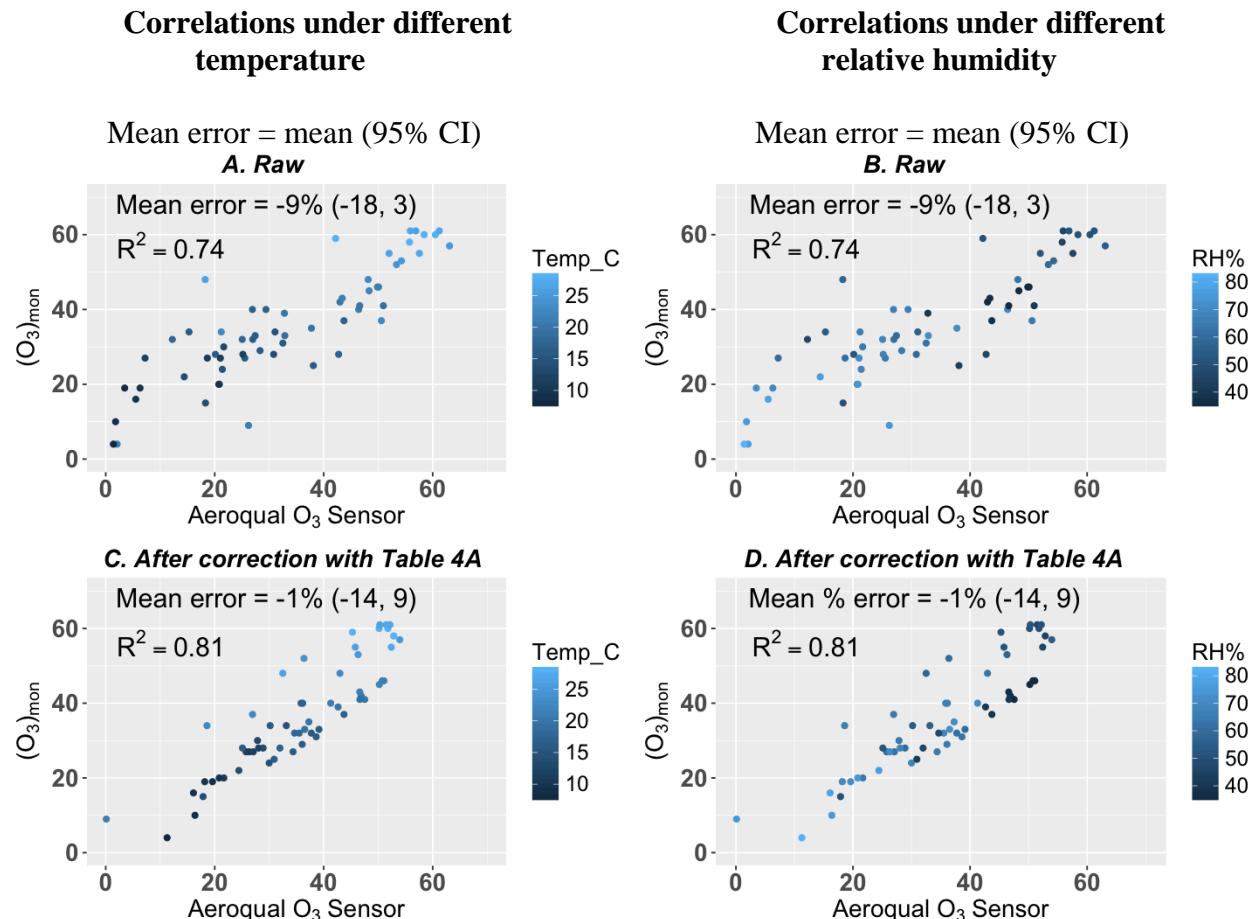
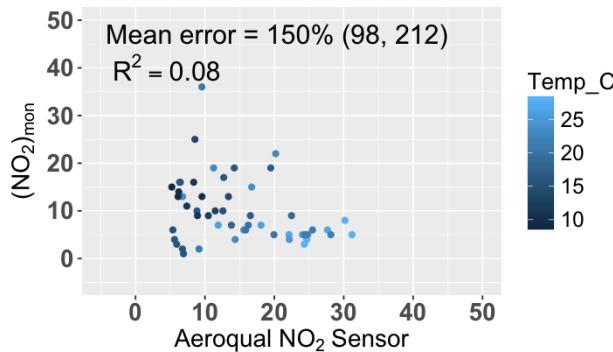


Figure S3: Correlation plots of Aeroqual O_3 sensor and $(O_3)_{mon}$ from the testing dataset (data from second and third co-locating periods merged together to form one dataset), R^2 = coefficient of determination based on linear regression, $(O_3)_{mon}$ = O_3 measured with a photometric O_3 analyzer, Aeroqual O_3 sensor = O_3 measured by the Aeroqual GSS O_3 sensor, RH² = squared measurements of relative humidity ($n = 60$).

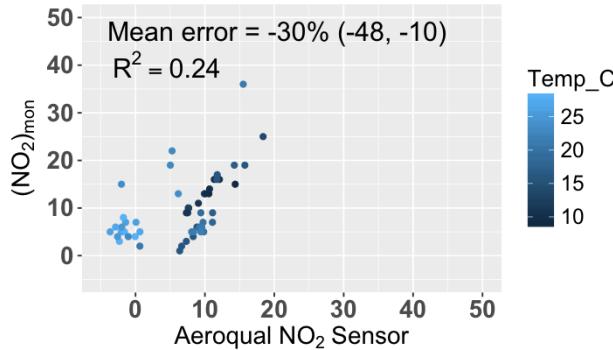
Correlations under different temperature

Mean error = mean (95% CI)

A. Raw



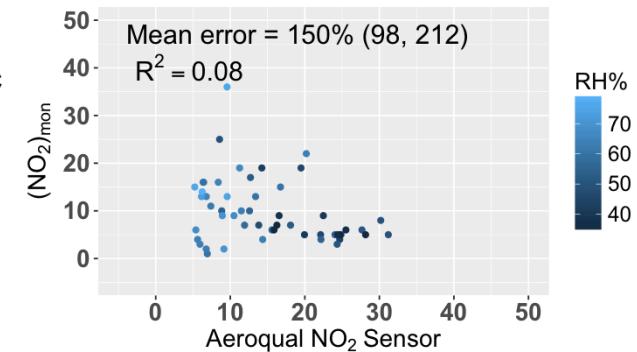
C. After correction with Table 4B



Correlations under different relative humidity

Mean error = mean (95% CI)

B. Raw



D. After correction with Table 4B

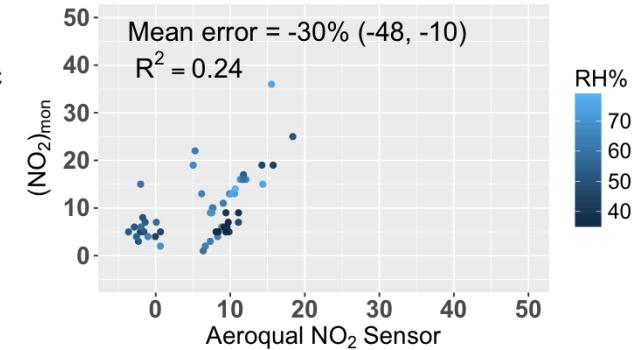
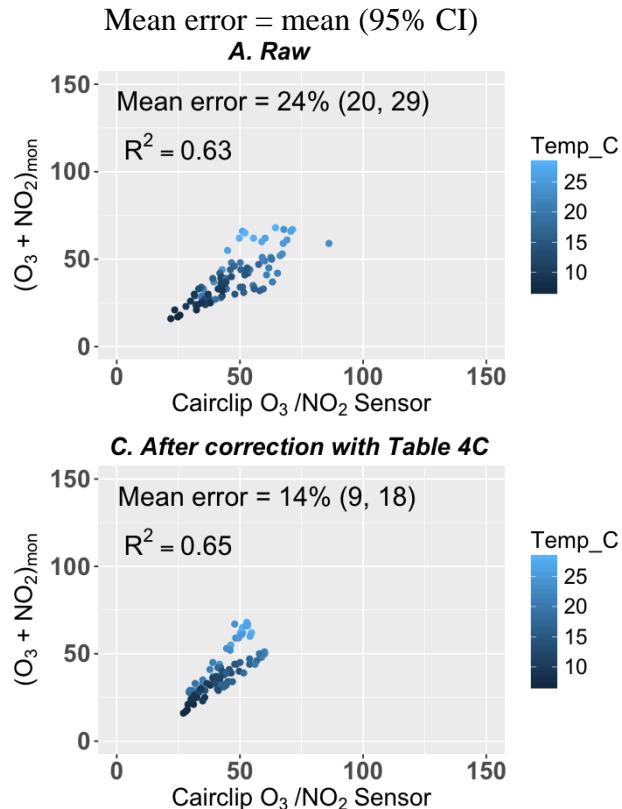


Figure S4: Correlation plots of Aeroqual NO₂ sensor and (NO₂)_{mon} from the testing dataset (data from second and third co-locating periods merged together to form one dataset), R² = coefficient of determination based on linear regression, (NO₂)_{mon} = NO₂ measured with a NO_x chemiluminescence analyzer, Aeroqual NO₂ sensor = NO₂ measured by the Aeroqual GSS NO₂ sensor (n = 52).

Correlations under different temperature



Correlations under different relative humidity

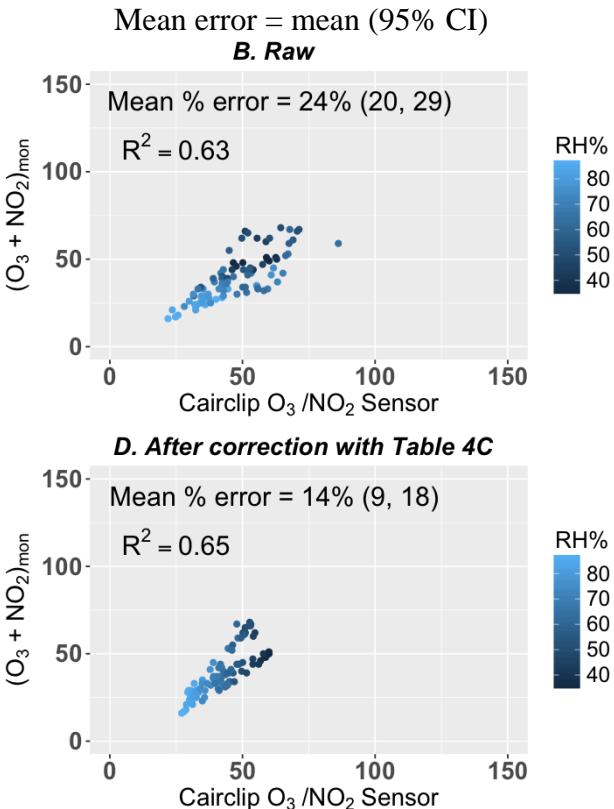


Figure S5: Correlation plots of Cairclip O₃/NO₂ sensor and (O₃+NO₂)_{mon} from the testing dataset (data from second and third co-locating periods merged together to form one dataset), R² = coefficient of determination based on linear regression, (O₃ + NO₂)_{mon} = the sum of O₃ and NO₂ measured by NOx chemiluminescence and photometric O₃ analyzers, respectively, Cairclip O₃/NO₂ sensor = O₃+NO₂ measured by the Cairclip O₃/NO₂ sensor, n = 91.