Certificate of calibration

For:	Dr Liselotte Tinel WACL National Centre for Atmospheric Science University of York Heslington York YO10 5DD United Kingdom
Date:	6th November 2018
Serial Number of Instrument:	#1752DB
Results:	**OZONE_2B nmol/mol = 0.9921 NCAS Primary Standard nmol/mol + 1.9352 nmol/mol** Uncertainty at amount fractions greater than 100 nmol/mol = ±3% of value. Uncertainty at amount fractions between 0 and 100 nmol/mol = 3nmol/mol.
Carried out and authorised by:	Dr Katie Read NCAS Scientist University of York York, UK
Signed:	

Reference to NIST Scale

The NCAS Primary Standard (TE49i) is calibrated annually at the National Physical Laboratory against the NIST Standard Reference Photometer SRP 20, quality assured and controlled by independent audit procedures. The calibration performed relates the output from the NCAS TE49i analyser front panel to the ozone amount fractions determined by the SRP.

The most recent calibration (7th March 2018) of the NCAS Primary Standard reported: -

TE49i nmol/mol =0.992 SRP20 nmol/mol + 0.2 nmol/mol

Measurement procedure

The visiting instrument is calibrated in the same way. The sample line used, had previously been conditioned at an amount fraction of 800 nmol/mol of ozone for over an hour.

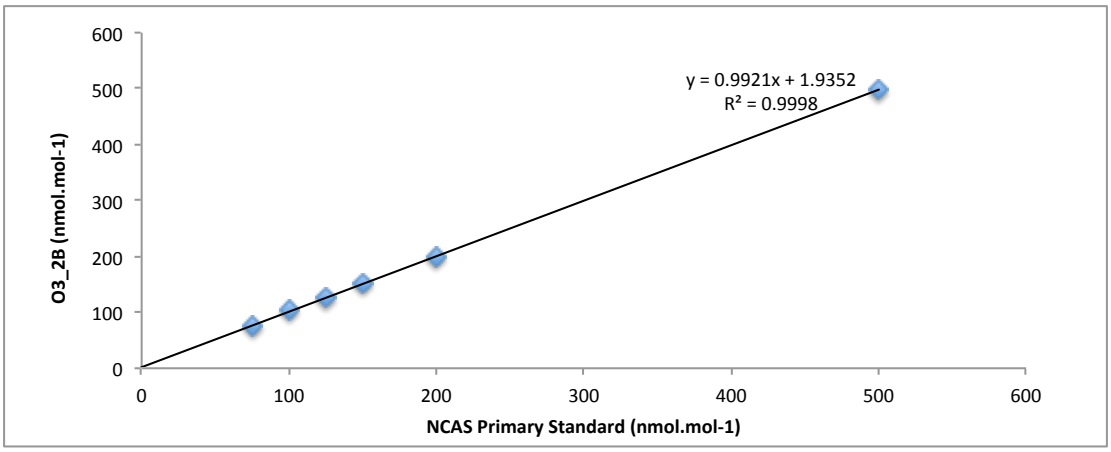
The second of two calibrations were used to generate the calibration data.

Ozone 2b Ozone output in nmol/mol = **m** NCAS Primary Standard nmol/mol + **c**

where: **m** is the gradient determined as the ratio of the visiting instrument reading for ozone to the TE49i reading for ozone and **c** is the zero intercept expressed in nmol/mol.

Results

NCAS Primary Standard (nmol.mol-1)	FAAM 49C (nmol.mol-1)	Standard deviation (nmol.mol-1)
-0.47	-2.47	0.40
100.03	104.52	0.48
150.04	153.26	2.00
200.01	200.19	3.90
75.02	76.22	0.45
125.01	125.11	0.43
500.15	497.01	0.43
-0.51	1.81	1.65



OZONE_5 49I Ozone nmol/mol = 0.9921 NCAS PS nmol/mol +1.9352 nmol/mol

The above equation is only valid in the amount fraction range 0-1000 nmol/mol.

Uncertainty is generally quoted as ±3% for amount fractions greater than 100 nmol/mol and 3 nmol/mol for amount fractions between 0 and 100 nmol/mol.

These uncertainties contain components arising from the uncertainty in the ozone absorption cross section, the purity of the air supply used in the calibration, any non-linearity in the analytical instrumentation, and bias in the primary standard used (based on the results of international intercomparisons).

Precision of the instrument has been calculated using the zero data and by applying the following formula:-

Precision = √(2 x standard deviation of 10 x 1 minute data points)

The precision is 0.90 nmol/mol for this instrument, which is a little high and may be to do with the limitations of the pump.

We recommend that you carry out calibrations at least annually to verify the stability of your analyser.

This work was carried out in the COZI-Lab in the Wolfson Atmospheric Chemistry laboratories (WACL) at the University of York. The COZI-Lab is principally funded through the National Centre for Atmospheric Science (NCAS).