

Reply to

Interactive comment on “The IAGOS NO_x Instrument – Design, Operation and First Results from Deployment aboard Passenger Aircraft” by Florian Berkes et al.

Anonymous Referee #2

Received and published: 23 February 2018

The submission by Berkes et al. presents a thorough description of a NO_x instrument that has flown routinely on commercial aircraft as part of a larger package with several other instruments. The measurement is based on the chemiluminescent detection of NO and NO₂ (after photolysis to NO). The photolytic converter for NO₂ is a major improvement over prior instrumentation used in such flights. The instrument is thoroughly characterized, and some representative measurement results are presented.

The paper can be published essentially as is, though some minor points should be addressed. Also, although perfectly clear, the English could be improved in spots. A few representative examples are noted below, but by no means complete.

We thank the referee for her/his comments, which we address (in bold) point by point in our reply below.

Minor points:

p.2, lines 4-5: please explain why production rate most favorable in the UT. Is this in regard to efficiency or total amount produced? Why not more favorable where heavily polluted? Rate is higher there.

We have removed this sentence because it adds confusion and is not needed for our arguments.

p.4, line 22: NOD not yet defined.

Corrected

p.5 line 25: Is the 18 kV AC or DC. If AC, what is frequency?

The high-voltage transformer is operated by a pulsing DC source, running at 250 Hz. The HV transformer thus generates 18 kV at a frequency of 250 Hz. We added the frequency value to the text.

p.7, line 32: Would be useful to cite numerical value for sensitivity.

We included:

“As an example, for a detector sensitivity of 1000 cps pptv⁻¹ the uncertainty is 30 cps pptv⁻¹. Please note, the detector sensitivity is not a constant value and it decreases during the deployment.”

p.10, line 33: Better to say O₃ concentration (in cm⁻³) rather than mixing ratio (dimensionless).

This is correct. We convert the mixing ratio in concentration. We changed this in the text.

p.11, line 27: depending / change to dependent

Changed

p.11, line 30: An uncertainty in NO₂ not acknowledged is that due to the use an NO value that is not simultaneous with NO_x detection. NO₂ error can be much larger if mixing ratios are varying, when NO is uncertain.

The reviewer is right that we cannot provide simultaneously NO and NO_x measurements with the IAGOS NO_x instrument. However, during night time NO is converted to NO₂ which is therefore measured via NO_x.

In Fig. 7 we show the uncertainty for NO₂ for day and night time, where we tried to demonstrate that the uncertainty for NO₂ is larger during day time, when NO is not zero.

At the current stage, the instrument switches between the NO and NO_x mode every 30s. Each NO₂ data point is calculated by subtracting the median of the NO measurements before and after each NO_x cycle. We cannot provide a better estimate for the “true” NO value and this makes it even more difficult to estimate an uncertainty for NO₂.

p.14, line 26: agree / change to agrees

Changed

P.14 line 28: “with to” / change to “by”, “by” / change to “from”

Changed

p.15, line 10: typo: “plum”

Corrected

Fig. 12, the right side of the box for the plume could probably be shifted left about 15 minutes.

We changed the range of box.

p.16, line 5: depending / change to dependent

Changed

p.16, Line 13: units of sensitivity?

It is counts per second per pptv (cps pptv⁻¹)