

Interactive comment on “Aircraft based four-channel thermal dissociation laser induced fluorescence instrument for simultaneous measurements of NO₂, total peroxy nitrate, total alkyl nitrate, and HNO₃” by P. Di Carlo et al.

Anonymous Referee #2

Received and published: 15 December 2012

Review of Di Carlo et al.

Di Carlo and collaborators describe a recently constructed 4-channel thermal dissociation laser induced fluorescence instrument for aircraft measurements of NO₂, ΣPN, ΣAN, and HNO₃. The instrument design is based on a similar Berkeley instrument previously described by Day et al. (2002) which has been validated on several occasions (e.g., Wooldridge et al., 2010).

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The manuscript is well written and I personally found it an interesting read. Overall, I found that the manuscript itself does not contain anything dramatically novel; however, I suppose that it can still be relevant and of interest to this journal's audience. I therefore favor publication, but would ask for inclusion of more ambient measurements and their discussion prior to publication to strengthen the paper and my comments below to be addressed.

General comments 1) While the NO₂, ΣPN, and ΣAN measurements are validated, there is no validation of the HNO₃ measurement, which of the four species is the most challenging to measure accurately.

2) Throughout the manuscript, the authors use the acronyms PN and AN, but ΣPN and ΣAN are also used. I am not sure if there is a distinction between these two I am missing, but it seems to me that they are one and the same. If so, please either correct or clarify. Also, since the authors consider N₂O₅ as part ΣPN (Figure 10), please include NO₃ and N₂O₅ in its definition (page 8762, line 2).

3) Please comment (in the manuscript) on whether any of the instrument channels is sensitive to interference from aerosol nitrate (either organic or inorganic).

4) Please state figures of merit of this instrument (detection limits, weight, power consumption, dynamic range, accuracy, precision, etc.) in an appropriate section of the paper (some of this information is currently buried in a section labeled "data retrieval and calibration").

5) I agree with the first reviewer that several key papers in this area have not been cited, for example:

Wooldridge, P. J., et al. (2010), Total Peroxy Nitrates (SPNs) in the atmosphere: the Thermal Dissociation-Laser Induced Fluorescence (TD-LIF) technique and comparisons to speciated PAN measurements, *Atmos. Meas. Tech.*, 3(3), 593-607.

Fuchs, H., et al. (2012), Comparison of N₂O₅ mixing ratios during NO₃Comp 2007 in

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SAPHIR, Atmos. Meas. Tech., 5(11), 2763-2777.

Specific comments - page 8763, line 14. This new approach has not just been proposed, but demonstrated on numerous occasions. Please rephrase.

page 8766 - Sampling and inlet system. Please specify whether the instrument is operated with an inlet or not, and briefly discuss any potential artifacts arising from aerosol nitrates.

page 8766, lines 21-22. It is my recollection that photochemical PAN sources do not work well with thermal dissociation methods due to the relatively high acetone content. Has the output of the photochemical PAN source been verified using a method other than TD-LIF? At the minimum, a comment on the performance of the photochemical PAN source is warranted.

Page 8770 - 8771. Consider condensing this paragraph.

page 8772-73. It is mentioned that the instrument flew on 25 occasions, but the comparison is only shown for short segments (3 hours in Figure 9 and a 100 min segment in Figure 10). Can you comment on how the rest of the data compared? As I said earlier, inclusion (and discussion) of more of the flight data would, in my opinion, strengthen the paper sufficiently to warrant publication.

Scientific Significance:

Does the manuscript represent a substantial contribution to scientific progress within the scope of Atmospheric Measurement Techniques (substantial new concepts, ideas, methods, or data)? yes

Scientific Quality: Are the scientific approach and applied methods valid? Are the results discussed in an appropriate and balanced way (consideration of related work, including appropriate references)? yes

Presentation Quality: Are the scientific results and conclusions presented in a clear,

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concise, and well-structured way (number and quality of figures/tables, appropriate use of English language)? yes

In the full review and interactive discussion the referees and other interested members of the scientific community are asked to take into account all of the following aspects:

Does the paper address relevant scientific questions within the scope of AMT? yes

Does the paper present novel concepts, ideas, tools, or data? new data are presented, but many of the technical aspects have already been published by others

Are substantial conclusions reached? yes

Are the scientific methods and assumptions valid and clearly outlined? yes

Are the results sufficient to support the interpretations and conclusions? yes

Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? yes

Do the authors give proper credit to related work and clearly indicate their own new/original contribution? not quite - some relevant related work is not cited

Does the title clearly reflect the contents of the paper? yes

Does the abstract provide a concise and complete summary? yes

Is the overall presentation well structured and clear? yes

Is the language fluent and precise? yes

Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? yes

Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? additional info needed (see above)

Are the number and quality of references appropriate? no

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Is the amount and quality of supplementary material appropriate? n/a

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 8759, 2012.

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