

## ***Interactive comment on “Laser induced fluorescence based detection of atmospheric nitrogen dioxide and comparison of different techniques during the PARADE 2011 field campaign” by Umar Javed et al.***

**Anonymous Referee #3**

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This manuscript describes a laser induced fluorescence instrument that has been developed for ground and aircraft based measurements of NO<sub>2</sub>. It describes the setup of the instrument, its calibration and examines possible interferences. There is also a description of data taken with the instrument during a field campaign that involved a range of different NO<sub>2</sub> detection techniques and a comparison of the different datasets is made. NO<sub>2</sub> is a key atmospheric constituent and it is important to develop new direct measurement techniques for it, making this type of work very topical. The manuscript is generally well written and provides an important reference for others wishing to de-

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velop an LIF instrument for NO<sub>2</sub> detection. I recommend publication subject to the authors dealing with the following relatively minor comments.

Specific comments: On line 254 it is stated that frequent zero-air measurements are necessary to monitor changes in the background signal. This is important as presumably the addition of air with zero NO<sub>2</sub> in it is the only way that the background signal of the instrument can be measured? I therefore think that more discussion should be had into this. Firstly, how is the zero air generated, is it just from a cylinder or is there some further scrubbing carried out? How do the authors know how much NO<sub>2</sub> is in their zero air, has it been measured? Some discussion should be had as to how the quality of the zero air affects the accuracy of the instrument.

In the instrument description section I feel that a diagram showing the timing of the laser pulse, PMT detection and fluorescence signal would be beneficial. All the information is there in the paragraph but a diagram would make things much clearer.

On line 144 it is stated that the PMT and laser are kept at a constant temperature by a water chiller but at what temperature? Would lowering the temperature help with reducing background. Or conversely if no cooling was present, which may make the instrument easier to operate on an aircraft, how would this affect instrument performance?

On line 199 it is stated that in the calibration system, about 99% of the NO is consumed by titration with O<sub>3</sub> to produce the NO<sub>2</sub>. Why do the authors choose to titrate this much? Surely there is a danger that they could have more O<sub>3</sub> than NO in the system and hence have the potential for secondary chemistry to affect the amount of NO<sub>2</sub> present? Would it not be better to titrate around 80% of the NO to NO<sub>2</sub>?

In the abstract it is stated that the instrument could be used for airborne measurements of NO<sub>2</sub> however there is very little discussion of this in the manuscript. There should at least be some discussion as to how the instrument precision and detection limit would change for 1 second averaging (which would be required for aircraft work) and how this

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compares to the potentially lower levels of NO<sub>2</sub> present in the free troposphere.

Technical: Figure 1: It would be clearer if the numbers were all the same way up on the page. Reaction 2: what is the wavelength of the fluorescence?

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-204, 2018.