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Interactive comment on "Forest Fire Finder – DOAS application to long range forest fire detection" *by* Rui Valente de Almeida and Pedro Vieira

Anonymous Referee #1

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The paper by Valente de Almeida and Vieira presents a detection system for forest fires based on the DOAS technique, and examples of its operation in 2015 in Portugal. The concept is interesting and should be published, nevertheless, there is room for improvement before publication.

Major Comments

The paper is too concise and does not present accurately enough the technical details. Lots of space is used to describe basic concepts (for instance of the DOAS technique) so the information content on what is actually new in the study is too sparse. The authors seem to have done enough and collected enough data for a paper, but in my opinion they need to explain more what they do.

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Figure 1 and Figure 3 are not very relevant for the study since they describe set-up which are not used (wireless sensor network, active doas). However, we miss a figure with a map of the 13 FFF system in the forest. We also miss typical DOAS fits corresponding to a fire detection, and a picture of the instrument on site. As described, the detection is a black box to the reader. We read that the system is trained to recognize smoke scenes, but what are the main criterion for the presence of smoke in the algo in the end?

The authors mention twice that other papers are in preparation: P7 l 21 'These devices are out of scope for this paper ... will be revisited for another article...'. and P7 L 30: 'During the night, this camera is also used... shall also be approached in another publication'. As the paper is rather short, I believe this additional material could be added to the paper instead of adding publication.

Minor Comments

Introduction

The authors should mention the species emitted by fire (NOX, CO ...) and include in the reference list some DOAS studies on forest fire, eg from space

Spichtinger, N., Damoah, R., Eckhardt, S., Forster, C., James, P., Beirle, S., . . . Novelli, P. C. (2004). Physics Boreal forest fires in 1997 and 1998 : a seasonal comparison using transport model simulations and measurement data, 1857–1868.

Castellanos, P., Boersma, K. F., and van der Werf, G. R.: Satellite observations indicate substantial spatiotemporal variability in biomass burning NOx emission factors for South America, Atmos. Chem. Phys., 14, 3929-3943, doi:10.5194/acp-14-3929-2014, 2014.

I also suggest to mention other routine monitoring applications using DOAS such as volcanic monitoring from space

Brenot, H., Theys, N., Clarisse, L., Geffen, J. Van, Gent, J. Van, Roozendael, M.

Van, & Hurtmans, D. (2014). Support to Aviation Control Service (SACS): an online service for near-real-time satellite monitoring of volcanic plumes, 1099–1123. http://doi.org/10.5194/nhess-14-1099-2014

or from ground

Galle, B., Johansson, M., Rivera, C., Zhang, Y., Kihlman, M., Kern, C., . . . Hidalgo, S. (2010). Network for Observation of Volcanic and Atmospheric Change (NOVAC)âĂŤA global network for volcanic gas monitoring: Network layout and instrument description. Retrieved from http://www.agu.org/pubs/crossref/2010/2009JD011823.shtml

The author could quote IPCC and/or references therein for the observed and predicted increases in number of forest fires.

On the other hand, the prediction of 11.53% increase of the market between 2014 and 202O (p2 l.11) does not seem serious.

State of the art.

References are needed for the satellite instruments

3. The technique

Active DOAS could be skipped, both text and figure since it is not used in the study

If the authors choose to be pedagogical with DOAS, they need to explain the symbol used in the equations, this is done after eq 3 but not eq 1 and 2 so the explanation of I Io, sigma, c and L should be at the beginning for the sake of clarity

Equation 4 should be modified, the integral is on the optical path for the slant column, the authors wrote that the integral is on the atmosphere which can be confusing with the vertical column.

P 6 L 22 We miss a reference for the Ring effect

P 7 L 3 Overdetermined does not imply that there are many possible solutions, on the

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contrary, but it does imply a criterion to select a state close to the solution.

The authors seem to have used the QDOAS software but it s not explicit. Can they be more explicit on that?

Figure 7: The y axis for Optical thickness is labeled 'AU' but the optical thickness is a dimension less quantity

Section 5.2.2

As mentioned above, we miss details and figures here. The authors should also be more explicit on the training of their algorithm. Where were recorded the spectra? At the same place, with fires? What are the columns of the different absorbers in the 'detected' spectra?

Section 6

It s not clear to me how we can say that true detection and false positive vary in similar way. I understand the authors'explaination of why it could be the case but how can we see it from the table 2? It seems that we would need time series to see such a link.

About the false detection on cloudy days: with more details on the different columns for the 'detected' case, the authors could discuss more accurately their assumption. These false alarm could be linked with variation in the O4 column due to clouds, which may also occur in fire smoke.

Technical comments

P.5, l.6 : 'of (the) its cross section'

P.7 L.25 : 'an fibre otpics' -> an optical fiber

Conclusion

Again the 11.53% which is hard to believe.

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