This paper describes the use of a DOAS system for the detection of forest fires.

This system is a very interesting application of DOAS technique for the indirect detection of the smoke columns over the horizon.

However, the explanation of the physical principle that resides under the indirect detection of the smoke using DOAS, that is, what can DOAS detect that can be understandable as smoke should be much more detailed in the text.

The article should address some mayor and minor comments prior publication.

Mayor comments

In this paper is very confusing not to know what is going to be retrieved by using something that is based in DOAS but is not exactly DOAS. In the section "Automatic smoke detection" it is mentioned that the column of several absorbers as water vapour, O_2, O_4 and O_3 shows an abrupt change during a forest fire event. Lately NO_2 is also mentioned as a target specie. Please unify criterion.

Authors should explain in more detail what the target species for identification of presence of smoke are and why (for example showing a figure of the mentioned abrupt variation). Molecular oxygen is not a usual target for DOAS retrieval, please could authors indicate in what spectral interval is retrieved?

Even when the exact calculation of SCD of O_2, ozone, NO_2 or O_4 SCD is not an objective itself for FFF, it would be necessary to see a figure with the spectral fits of these species without and with smoke, in order to see how well performs the DOAS part of this instrument. A more detail in the parameters used in the analysis would be also necessary (i.e., interval fit for every absorber). Temperature dependence of O_3 and NO_2 absorption cross sections is not taken into account even when temperature of the scanned air mass is an important feature for this application, could authors explain why?

What is the reason for the mentioned strong variation observed in the SCD when smoke column is detected? Change in concentration, change in optical path, change in the temperature on the air masses over the forest fire? Strong variation observed into the retrieved SCD for some gases, should be better documented and I would like to see a figure where this abrupt change could be seen, retrieved using the FFF system.

It is necessary at this point to know what is the reason that provokes this strong change in the observed SCD, in order to detect the reason for false positives: how can be, for instance, a situation during a Saharan dust event distinguished from the presence of a smoke column?

The detection of smoke using FFF is also based in the observational strategy, SCD of absorbers is calculated by using a set of three different reference spectrum. This should be explained in more detail, an example of the selection of the spectrum that is selected for further analysis, as mentioned in page 10, line 28 would be very helpful. It is not very clear to me why is necessary to compose an average spectrum and running through a peak detection routine. Why is necessary to detect peaks in the spectrum? It not clear either what average the system is calculating: what spectra are used? How this can lead to isolate the target spectrum?

I found that there is a connection between the three kind of references mentioned in page 10 section 5.2.1 and the three classification results enumerated in page 11 section 5.2.2., but it is no easy to link these two facts from the text, please explain this in more detail.

Minor comments.

Please make larger figures, some of them as figure 5, 6, 7, 8 and 9 have very small fonts and are difficult to read.

In the State of the art, page 2, three different kind of methods for forest fire detection are mentioned. It would be interesting to address in which of the three methods can be FFF included (if any) or indicate if FFF relies on a different new method that has been not used at the moment. It is no clear to me if FFF could be addressed into the "Large Area Remote Sensing".

Figure 1 is not significant for this work and should be removed.

Page 3, line 8. Please convert miles into km.

In the part corresponding to the brief description of the commercial devices used at the date for forest detection, it would be useful to know what the advantages of FFF over the previous systems are (minimal human intervention, maybe cost?).

It is also mentioned in this part of the text that as FFF operates in an outdoor scenario, results are not as quick as they could be in a lab experiment. This is the case for most monitoring DOAS systems, but I imagine that in this kind of application, results should be available in real time, is this the case of this system? This should be mentioned in the text.

In the section "The technique", I found the explanation a little bit messed up. For instance, magnitudes on the equation 1 are not explained until 10 lines below (and not all of them). They should be explained next to the equation, especially when in line 5-9, there is some discussion on $I_0(\lambda)$ when it has not been defined yet. Please re-organize this section.

Page 5 line 8. Amongst the environmental effects that affect DOAS measurements, multiple scattering should be included as the aim is detect smoke.

Page 5 line 9. Please explain what is instrumental light scattering, are authors referring to straylight here?

Equation (3). Please explain A(λ,…) in more detail. What "…" is? In line 16 page 3 is defined as a ratio but it is not indicated of what magnitudes is this ratio.

Page 6 line 8. SC_i is mentioned as the result of passive DOAS measurements, but this is only true when $I_0((\lambda)$ is known, what is not usually the case for this kind of measurements. In fact this erroneous concept is propagated along the explanation affecting other parts of the work. This connect to figure 7, how can authors explain the existence of negative optical thickness? (please notice as well that optical thickness is a non-dimensional magnitude).

Page 6 line 14,

by spectral profiles authors mean spectral features?

"quicker" and more important spectral signatures, is not a clear nomenclature, please rewrite this part.

Equation (6) magnitudes are not defined.

Equation (7) needs further explanation. Where the magnitude A(λ,…), Mie and Rayleigh scattering terms are?. What the new terms ΔSC_i and $a_j\lambda^j$ are? To eliminate $I_0(\lambda)$ is not as straightforward as authors mean, please notice that Iref is also affected by absorption and scattering and this is not mentioned in the step from equation (5) to (7), this is a part of what I meant in the previous comment of line 8 in this same page.

Page 7 line 6, Ring effect is not compensated but treat as an absorber by using a pseudo-absorption cross section. A small explanation, as this part of the work is mainly pedagogical, should be included about the calculation of this cross section and please include a reference.

Page 7 line 14. Please, if FFF does not apply directly DOAS technique itself, please indicate the differences with DOAS or in which way the technique is going to be used. This is an important part, especially when an important effort has been made to introduce DOAS technique.

Page 7 line 15. System is not measuring its surroundings but something in its surroundings, please specify what.

Section “The Device” What is the Field of View of the telescope?

Section “Results and Discussion”

I understand that the percentage of false positives are low when compared to the high number of analysed spectra per day, but the reliability of this system should reside on the correct detection of forest fires, so the analysis of false positives is an important part that need to be improved. Authors should indicate if further work is going to be done in this line and indicate how this weakness of the system can be improved.

It is interesting that most of false positives are due to presence of clouds, especially when DOAS can be also used to detect clouds and even aerosols. I don’t know if authors are aware of the previous work in this area (Gielen et al., Atmos. Meas. Tech., 7, 3509–3527, 2014 www.atmos-meas-tech.net/7/3509/2014/ or , Wagner et al., Atmos. Meas. Tech., 7, 1289–1320, 2014 doi:10.5194/amt-7-1289-2014).