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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Long-range transport of biomass burning smoke to Finland in 2006" *by* L. Riuttanen et al.

Anonymous Referee #2

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The paper propose a new methodology to quantify the contributions from wild fires along the path of backtrajectories. The authors use this and measurements on 3 different stations to understand how the aerosol ages, what and how much is emitted of different pollutants among other things. The method, however, is poorly explained or debated and gave me doubts if it is really correct or not. English needs revision, as well as the introductory text. I suggest not to accept it without major changes.

P.4290.L.4- typo: Back tracjectory method

P.4291.L.20- typo: remove the comma before ", should"

P.4292.L7- It is confusing. Up to here, authors were discussing about boreal forest fires. First paragraph on previous page even states that the sign of radiative effects of

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Interactive Discussion

Discussion Paper

boreal forest fires on climate is unkown.

P.4192.L.5- typo: you probably mean "intense"

P.4292.L27-P.4293.L5- The authors discussed many papers whose authors have studied the same 2006 biomass burning episodes. Here, however, they fail to distinguish their work from the previous ones.

P.4294.L7- "strict nature reserve" is probably not the right term here

P.4295.L2- what is meant by "radiation of the stand"?

P.4295.L7- How many wavelengths does the instrument have? Why using only 880nm?

P.4295.L23- Line starting with "Classically,..." seems uncessary

P.4296.L5- Unclear text. The authors say that surface area is of interest, just to then say they will use something else (condensation sink).

P.4297.L1- typo: trajectory

P.4297-4298- The definition of the firesum seems to be of utmost importance, not only for the further analysis, but to differentiate their work from others. The idea seems promising, but the authors failed to properly explain their methodology.

For instance, it is not clear what is meant by "normalized with that radius". Is it a simple average of the pixels within a radius of 10% de length of the trajectory? or is there a gaussian weighting between 0 and 10%length ?

They also say that the time "t" after the tracjectory passes over the last fire would indicate the time-scale of the losses' processes. This would only be true, however, if the concentration in the air parcel does not depend on its previous history. When the air-parcel is over the last fire spot, however, its composition is a combination of fresh material emitted at its current location, as well as, from all upwind fires (which necessarily already suffered some decay).

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The definition of "t" in equation (1) seems to be different from the discussing of the decay time, or in eq. (2). Hence, it is unclear if the procedured adopted for the calibration (determination of C0 and tau) are appropriate.

Last, as the author noticed, fire power varies along the period. Moreover, depending on the kind of vegatation, different emissions will occur. Therefore, it would be best to use the fire radiative power directly, and a vegetation map, to estimate the emissions. Still, as they are calculating backtrajectories every hour, they should remember/discuss that Modis passes only twice a day.

P.4300.L15-25. Although the result in Fig.3 seem to indicate a difference between smoke and non-smoke periods, the analysis shouls include the calculation of the standard deviation of these frequency distributions for each bin. By comparing each curve with its confidence levels can one say the different is statistically signficative. The authors could also consider "fire sum" as a variable and compute the same histograms.

P.4302.L5-15. A life time of 63h seems rather large and can steem from the difficulties in the determination of tau and C0. The authors could, however, could had estimated the life time by the decrease in concentration between their stations as they know the travel time (distance) and have the measured values.

P.4308.L9-L22. Despite what the authors claim, the correlations presented between the concentration of pollutants and the "fire sum" variable are not large (largest value is only 0.52 or -0.39). Moreover, no statistical test was applied to pinpoint which of the correlations are significative. It is also claimed that, O3 does not correlate well with fire-sum because it's a secondary product what is not clear since its precursors do correlate well. Finally, instead of only showning the correlations, table 3, the scatter plots should be shown.

P.4309.L4-10. Author say that the life time of 12h gave the best correlation, but none of the itens in table 4 have 12h life time which is confusing. Moreover, they conclude that MODIS+Hysplit is a valuable tool because the correlations between ground observa-

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tions and fire-sum are good, which are not (largest value is 0.52)

P.4309.L.21- If this is the case, the authors should compare the ozone concentration of the three stations, which lie on different distances from the last fired-pixel.

P.4310.L14- The life times of various elements are given in table 4 and discussed in this paragraph. The table, however, does not give any estimate of the uncertainty in the values (e.g. from the fitting of eq 2). What is called emissions are actually concentrations near the source, right (C0 is for t=t0)?

P.4311.L11-16- If both peaks came from fires, why is it an indication of secondary particle formation?

P.4311.L23- But Helsinki is closer to the fires than Hyytiala, isn't it?

P.4311.L25- typo: pbserved

P.4312.L26- typo: higher than usual

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 4289, 2013.