

## ***Interactive comment on “An important fingerprint of wildfires on the European aerosol load” by F. Barnaba et al.***

**Anonymous Referee #2**

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### General comments

This paper addresses the question on the importance of wildfires fingerprint on the European aerosol load. The authors use long-term (2002–2007) remote sensing observation of the Aerosol Optical Thickness (AOT) and fires combined with atmospheric transport simulation to evaluate the role of the fires play on the aerosol load at the continental scale. As the authors show, the impact of fires is visible over Europe. The regions most impacted by wildfires emissions are Eastern and Western Europe, as well the Scandinavia; the calculated impact maximizes in April. Another important conclusion is on the fine fraction AOT attributed to the wildland fires. The manuscript is for the most part clearly written, the method is described with enough information to reproduce the results. The manuscript is within the scope of ACP. However, besides

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the comments mentioned in the section “Specific comments” I kindly ask to consider the possible influence of the error of the Hysplit trajectories on the results. Overall, from the literature, one can estimate the total error to be anywhere from 15 to 30% of the travel distance. This error might change the results considerably. Trajectories accuracy should be taken into account. The agreement between the results obtained with backward and forward trajectories might be one of the proofs that the air mass trajectories technique might be used in those studies.

### Specific comments

- p.2318, line 7. To my knowledge peatland fires, and, as a consequence, forest fires in central Russia are most crucial for the atmospheric composition changes.

-Schematic figure on the seasonal difference in the air mass transport directions to Europe as an addition to Figure 1 (monthly mean fire counts) will better explain difference in AOT and FFAOT between the target regions. Meteorological fields in spring are mentioned to be favourable to eastern transport, how about other seasons? Can the minor impact which is found in Western Europe and Mediterranean be explained by the other than eastern transport? As a possible reference, Stefan et al. (Physics and Chemistry of the Earth, Parts A/B/C Volume 35, Issues 9–12, 2010, Pages 523–529) might be used; some statistics for the air mass origin/transport can be obtained also from seasonal averaging of the Hysplit trajectories. Figure with the actual wind speed/direction scaled to area including Europe and surroundings might also be used together with Figure 1 for the better explanations of the results presented in Figures 4 and 5.

-p.2324, line 3. What is the lifetime for the biomass burning aerosols? What is the fraction of the biomass burning aerosols left after 5 or 7 days of transport? Why the 10-days length of the air mass trajectories was chosen? I assume that for the same computation expands the 5(7)-days trajectories with lower than 2.5 deg horizontal resolution would give more accurate results

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-There is an option in the Hysplit tool to calculate the mixing layer depth (=boundary layer height). I wonder why that option was not used to be sure the air parcel was within the boundary layer when travelling forward. The part of the trajectory before (if) the air parcel leaves boundary layer should only be used in the calculations. I agree that the differences in the results for the forward trajectories for different starting point are not always significant, even though not negligible. However if to consider the height of the starting point, in northern latitudes (above 60°N) in winter the boundary layer height decreases often to 300-400m, and can be only few tens of meters occasionally. I suggest to make a test run for Scandinavia considering the boundary layer height obtained with Hysplit.

-Chernobyl accident can be mentioned as an example of the transport, but separately from the agricultural fire activity maximum (as it is on line 26, p.2319).

-p.2322, line 21. Since you use MISR AOT in the combination with the fires characteristics, please mention the MIST AOT accuracy for the biomass burning cases.

-p.2325, line 22. Provide the R for each of 7 target regions

-p. 2332, lines 10-14. Please add fitting line for April-July for the comparison.

-p. 2332, lines 14-18. Please explain in the text or in the Figure 8 caption the white spots on the maps around England and in Scandinavia.

-Conclusions should be formulated more clearly. I also suggest to move lines 13-24 from page 2331 to introduction (if you just formulated the existed knowledge) or show in the Discussion and Conclusions section how the existed knowledge on the topic was enlarged using the method discussed in the manuscript.

-The results on the intercontinental transport studies are not mentioned in the Discussion and Conclusions section.

Technical comments:

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p. 2322, line 3. Figure 1 is too heavy and not easy to read. Instead of shaded color I suggest to use letters a-g as the panels are named on figures 4-6.

p.2324, line 4. I suggest using the following format 20°W instead of -20° (as it is in the Figure 1 caption).

p.2326, line 25. Write "standard deviation" or "st.dev" instead

Altogether, I recommend to publish the manuscript after making the tests (for Scandinavia, as an example, winter or spring period) on the comparison of the results taking into account the trajectory accuracy and boundary layer height and after taking into account other minor modifications.

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 2317, 2011.

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