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Interactive comment on "Increased aerosols content in the atmosphere over Ukraine during summer 2010" *by* Evgenia Galytska et al.

Anonymous Referee #2

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The manuscript by Galytska et al. attempts to describe the impact of fires on the aerosol loads over Ukraine in summer 2010 using a combination of ground and space based remote sensing data. To my opinion the work would be more suitable for 'Atmospheric Chemistry and Physics' journal rather than for AMT. In fact, it analyses and discusses data, but does not provide or use any new 'measurement technique'.

That said, I also believe the manuscript is not mature enough for publication and needs major revisions.

Main drawbacks are: 1) Lack of novelty, or at least lack in communicating the novel aspects of the study with respect to the abundant literature on similar aspects of the same fires episodes. 2) Length of the text and use of language both contributing making the reading difficult.

The authors need to make an effort to synthesize the information, focussing on the main aspects of novelty they believe this work contributes highlighting.

Additional General comments:

- Please use either PAST TENSE or PRESENT TENSE, do not mix the two.

- Please introduce the acronyms the first time you use them or insert a list at the end of the manuscript (e.g., ETR, AOD, AERONET, WMO, SSA...)

- Full sentences taken from other papers should be quoted.

- I would suggest to use the term 'comparison' rather than 'validation' for the satellites vs AERONET cross analysis.

- List of references is often not given in the correct format.

- As already mentioned, the language should be improved. Some examples are given in the list of specific comments below. However this should not be considered exhaustive.

Additional specific comments:

Abstract.

Line 5. Use 'plus MODIS ..' rather than 'and MODIS..' Line 8. The term 'air pollution' seems too generic here. Line 9. The term 'combustion center' is misleading, it could be rather replaced by 'fires' (the same all over the text). Line 11. 'Were' should be 'was'. Line 16. Single scattering albedo is not a microphysical property. Line 18. Please specify better what you mean with 'highest' when talking about 'aerosol pollution'.

Introduction

Introduction is too long and should be rewritten. Now it is rather a long list of short summaries from each single previous study on the same matter. From my point of view, the Introduction should be rewritten so to report a synthesis on what we do know

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and not know from previous studies, the latter (presumably) driving the motivation for the current work. Then the novelty of this work with respect to these previous studies should be clearly mentioned. Page 2 line 5. Insert references at the end of such a general statement. Page 2 line 9. Remove 'are' at the end of the line. Page 2-3. Description of the results by Konovalov et al. (2011) is too long (16 rows) and should be shortened focussing on the major findings A first Figure introducing the study area and all the main sites/regions referred to in the text should be inserted.

Section 2.1

Page 4 Lines 8-9. This sentence is questionable and should be rephrased. I do not think it is a matter of rating best and worse remote sensing techniques. Page 4 Line 13. What do you mean by 'metrology' here? Page 4 Line 20. Correct into (Holben et al., 1998) Page 4 Line 21. Angstrom Exponent is used to describe the AOD spectral variability. It is not necessarily computed between 440 and 870 nm. Please clarify better. Page 4 Line 22. What do you mean with 'altitude circle'? Do you mean 'principal plane' measurements? Please clarify. Also insert a comma after 'Sun'. Page 4 Lines 29-30. Please list here which additional AERONET sites in Eastern Europe you used.

Section 2.2

Page 5 Lines 8-9. Please rephrase. Page 5 Line 11. Please rephrase. Page 5 Lines 14-16 . The MODIS product you used is obtained from both land and ocean MODIS algorithms, not just the land one. The fact that you only use land retrievals given the region under examination is a different thing. Please rephrase. Page 5 Line 27. This sentence should be rephrased as not clear in the current form. Page 5 Lines 33-34. The given link should not include a specific period as it is now. Page 6 Line 5. Should be just 'vegetation fires'

Section 2.3

Page 6 Line 12. Should be 'at nadir' Page 6 Lines 15-16. Should be 'CALIOP mea-

surements allow to derive aerosol and clouds vertical distribution...' or something like that. Please rephrase. In the current form, the sentence is not fully correct. Page 6 Line 19. 'Were' should be 'was'.

Section 2.4

Page 6 Line 27. 'on ' should be 'of' Page 7 Lines 1-2. Not clearly written. Please rephrase.

Section 3

Methodology and Results should appear in separate Sections. Page 7 Lines 4-5. This is a repetition. Please remove. Page 7 Lines 11-18. Please make this part shorter focussing on the main points affecting the way you can make use of the CALIOP dataset. Better explain which is your 'collocation' criteria for CALIPSO given the limitations described. Page 7 Lines 18-19. Not clear. Please rephrase.

Section 3.1

I think a better definition of the term 'summer' used throughout the text is needed. Isn't summer defined as June-July-August in your work? Why do you limit the fires analysis in Fig 1 to the period 1 July- August 20? And why Fig 2 shows data from June 1 to August 24?? Please clarify better the term 'summer 2010' since the beginning and try to be consistent with this in your Figures.

Please, show on Figure 1 the study area used in Figure 2

Page 8 Lines 1-2. Actually, given the large number of fires in Fig.1, it is not the best way to show 'fires concentration'. A metric like the number of fires per unit area should be rather used for this purpose. Either rephrase this sentence or modify Fig 1 accordingly.

Page 8 Line 3. If I understand correctly, FRP stands for Fire Radiative Power (please, provide acronyms). However, note that Fig 1 does not show FRP but T. Since these are different quantities, again either modify Fig. 1 or modify the sentence.

Table 1: From Table 1 (and relevant text) it is not clear to me which is the overall period considered to compute the values reported.

Page 9 Line 5. Replace with 'for dates of maximum AOD'. Page 9 Line 8- Page 10 Line 24. This part is too long and should be shortened. Figure 3: Use of different dates does not help the understanding of the atmospheric circulation over the area in the investigated period. I suggest including a figure with wind patterns over the whole region at the different levels and dates, to be coupled to fires info of Figure 1. As a further suggestion, it would be more useful to plot back-trajectories together with the fires data to better understand if and how each site was (possibly) impacted by fires.

Section 3.2

Section 3.2 is too long and confusing. It is not clear how much new information it contains with respect to Milinevsky et al. (2014). To my opinion, the authors should avoid describing what happens each couple of days and limit the analysis/discussion to the most important periods identified (e.g. those identified in Section 3.3), stressing on the results quantifying the fires impact over Ukraine in summer 2010 (as promised in the title). In doing so, it is important to clarify what was already known based on previous literature, and which are the new findings of this work. Figure 4b is redundant Figure 5 should be removed or inserted as supplementary.

Page 16 Line 7-9. This last part of the Section is perhaps the most interesting one, in the sense that it adds information with respect to previous studies. However, these sentences should be rewritten to be more clear. For example avoid saying 'The fires impact on aerosol size from AERONET observations can be estimated by knowing XXX and size distribution of the aerosol particles XXX' , as this is quite obvious. Again, the authors should try to focus on the most interesting results, without unneeded redundancy.

Figur6c: How do you explain the low values of SSA all over the spectrum in Jul18-Aug 14 with respect to Aug 15-17? Table 3. As already commented, SSA is not a micro-

physical property. Please, reduce the number of significant digits. I also recommend moving it to the supplementary, as it does not add much to results in Fig. 6.

Section 3.3

Page 17 Line 5. Again, caution using the term FRP as this was not introduced/shown in Section 2. Page 17 Lines 7-8. Unclear, please rephrase.

Section 3.3.1

This section is largely a description of the methodology to match AERONET and MODIS data. Page 19, Lines 3-25) could be better moved in a specific section within the Methods.

Figure 7 : I would use a different scale for the two panels. In the present form panel a) gives little information. Page 21 Lines 9-17. Language should be improved.

Section 3.3.2

Similarly to the previous case, this section is largely a description of methodology rather than of results. Please, try to separate methodology from results as this would help a lot the reading of the work. This section shows the same problem of others, i.e., it is structured as a list of dates with description of features, but lacks a synthesis of the main findings CALIPSO data tell us about the phenomenon under examination. It should be shortened and restructured so to highlight which is the important (possible quantitative) information CALIPSO adds to the overall picture.

Page 22 Line 5. Specify where (in altitude) the laser beam has a 70 m diameter. Due to the beam divergence, this is not the same all over the laser path.

Page 22 Line 10. What do you mean by 'estimated CALIPSO AOD using MODIS AOD'? Please clarify better. I do not see the reason for introducing the further term 'time-span' in this Section. Please identify specific periods of interest for the study, give them names, and use these all through the text. Page 24 Lines 16-17. What do

you mean by 'ground track'? Please specify. Page 22 Lines 17-19. Unclear, please rephrase. Figure 9. Please group profiles according to the three types you identify in the text. It is necessary to include labels a) to g) on a map (e.g. in Figure 8) to show the relevant location and better follow all the discussion in the text. Use the same X- and Y- scale for all plots to simplify the comparison.

Why not using the CALIPSO depolarization to further characterize aerosol layers?

Section 4

Page 27 Lines 6-17. I would avoid the discussion on the reason for CALIPSO and MODIS AOD mismatch here. It is not very pertinent to this study and in the present form contains several questionable statements.

In general, this section is also too long (3.5 pages). It has to be shortened once all the given suggestions have been addressed. It would be desirable to restructure this section in order to have a sort of 'main finding list' here.