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Interactive comment on "Using SEVIRI fire observations to drive smoke plumes in the CMAQ air quality model: the case of Antalya in 2008" *by* G. Baldassarre et al.

Anonymous Referee #2

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The article of Baldassarre et al. (2015) presents a case study of emission calculation and smoke modeling for a fire that occurred in Turkey, in the province of Antalya. Emissions are computed using FRP from a geostationary satellite obtained by two methods, and are compared to the more standard emissions obtained with FRP from MODIS. Then, multiple simulations are performed with the different emissions and results are compared to satellite observations of aerosol (AOT), CO and NH3. The main findings include rather large variations within geostationary FRP retrievals which propagate to significant changes in smoke concentrations both in magnitude and in location. Also, there is evidence that one of the FRP geostationary retrievals outperforms the

other and that the optimal one can improve model skill when compared to MODIS FRP based emissions. These results are novel and relevant to the ACP community, thus I recommend publication after the author address my comments.

Main comments

1) Why there such large differences between WF_ABBA and LSA SAF FRP for this fire given that they are obtained from the same satellite sensor? This is a major point of the article and the authors need to make a better job explaining the reasons of the differences. Right now they only describe the methods how the FRPs can be obtained and state that one product uses one method, and the other a combination of both methods, and later this is blamed as the reason of the differences very briefly. However, I think a longer and more in depth explanation on how the different methods create such a big change in FRP for this specific case is needed. Try including also reasons for the differences in temporal variability (Fig. 4a). It seems the LSA SAF performs much better than WF_ABBA when comparing to MODIS FRP, so it would be and advancement if the authors could report what went wrong with the WF_ABBA retrieval so this algorithm could be corrected in the future and also have it as a reference for other algorithms.

2) An important point of this article is the use of multiple observational datasets. I think there is still some missing observational evidence related to the vertical extent of the plumes. Please check CALIPSO overpasses to see if aerosol plumes were detected in the region for the period of the fire, and if they were, make a comparison along the satellite track.

3) The authors should include a more quantitative analysis comparing model and observed AOT in a similar fashion as it was performed for CO and NH3, even if the model completely underestimate AOT. Computing correlations for the whole area and point by point as done for CO could be informative too. In these lines, it would also be informative to perform one more test case where emissions are computed with LSA SAF FRP but with Ichoku and Kaufman conversion factors. These factors are based on matching

AOD, so it's expected that agreement to MODIS AOD would improve.

4) Methods are very extensive but results and discussion and very concise. The authors should expand the results and discussion section a bit to describe the results found in more depth.

Minor comments

1) Tables are not cited in order (e.g., the first table cited in the text is Table 2). Change the numbering of the table or the way they are cited.

2) Page 3, Lines 5-6. "Furthermore, the impact . . .."

3) Page3, Line 7, delete "indicate"

4) Page 3, lines 9-11, Are you talking about improvements recently included into CMAQ? Or saying that CMAQ is an improvement by itself? It is not clear what you mean by this, please rephrase. Page 3, Lines 11-12. "Therefore, emission inventories must also be provided . . ."

5) Page 3, Lines 13-14. "According to Garcia-Menendez et al. (2014), in addition. . .". It seems every time you want to cite a paper in the way "Author (year)", it is cited as "(Author, year)". Please correct this throughout the text.

6) Page 5, Line 2. ", had the highest . . ."

7) Page 5, Line 5. "A large forest fire occurred on 31 July 2008 in Antalya, Turkey's most touristic province"

8) Page 5, Line 7. ", a typical fire adapted. . ."?

9) Page 5, Line 9 "buildings"

10) Page 5, Line 13. The "Internal fire hazard report" is not in the references, include a link or some other way to track the source.

11) Page 6, Line 4-5, Wooster ref is in ()

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12) Page 6, Line 12. Erase "While" or use a comma instead of a period to separate both sentences.

13) Page 9, Line 7. Govaerts reference is in ().

14) Page 10, Line 2, Kaiser ref in (). Ichoku and Kaiser refs also in () in the same section

15) Page 10, Lines 15-22. Specify if the emissions computed with the Kaiser approach when comparing to Ichoku have the factor 3.4 included or not. Do the same for Table 1.

16) Page 11, Sofiev in ()

17) Page 11, Lines 12-13. Correct the parenthesis , seems to be either missing or extra ones

18) Page 11, Lines 14-15. "and its ability to reproduce the meteorological conditions including the region of interest . . ."

19) Page 11, lines 16-20. Also state that ECMWF is used and initial and boundary met conditions

20) Page 12, first paragraph. You say here emissions are uniformly distributed up to a certain height, which is not what's reflected in Fig. 4b. Please clarify.

21) Page 12, Line 8. Fig 13 is in the main text, not in the supplement. If you keep it that way, change the figure numbering so they are referred to in order in the text.

22) Page 12, Line 10. What does "ca." stands for? Or is it a typo?

23) Page 13, Line 14-15. You already make this statement earlier on the same page in line 5, right?

24) Page 13, Lines 18-21. This sentence is way too long, please split.

25) Page 14, Line 18. Rodgers ref is in (). Same for Van Damme (twice) and Walker

later in the same section

26) Make Fig 2 cover the whole width of the page, now its too small

27) Page 15, line 18. "even if" its not a good connector here, rephrase

28) Fig. 3. Does the labels representing dates show 00 local time? The steps when going from one daily emission value to the other seems to be shifted like 2 hours from the position of day label. Please correct.

29) Page 16 line 21- Page 17 Line 2. This paragraph should go in section 3.1, as the differences are due to FRP, not to how the emissions are computed. In section 3.2 just say that emissions differences are due to FRP differences explained in the previous section.

30) Page 17, line 4. Garcia ref is in ()

31) Page 17, Lines 22-28. In Fig 4 you are only showing that the vertical allocations are different, not that one if better than the other, as you seem to be stating ("can lead to a more accurate vertical allocation").

32) Fig. 4. Is TPM the same as PM2.5? It seems that way from Fig 4a axis label and caption

33) Fig 4a. Time label starts at 4, not at 0? If starts at 4 then add this label, otherwise is confusing

34) Fig 5. I understand why GFAS has the same emissions for Aug 1 at different times (column 1 and 2), but they should be different for Aug 2 (column 3) as shown in Fig. 3. Right now all three panels are the same. Please clarify

35) Page 18, line 20. Garcia ref is in ()

36) Fig 14 is not in the supplement, is in the main text. Change figure numbering and order if necessary

37) Page 19, Lines 10-11. MODIS AOD retrieval is performed by aggregating info from 1km pixels (see Levy et al., 2007). Since the smoke plume is so concentrated it labels those pixels as clouds, and performs the AOD retrieval in the rest of the pixels, which are clean. This is why it gives the impression is putting low AOD where the plume is. You should explain this as a retrieval limitation, and not just leave it as a wrong attribution.

38) Fig 6. Caption should be "by subtracting concentrations from simulations without fires"

39) Page 19, line 25. I would delete the "Very" at the beginning. In my opinion, very high PM2.5 concentrations would be something like over 100 ug/m3

40) Page 20, line 9. "From these figures . . ."

41) Page 20, line 9-13. English is not proper in these sentences, rephrase or correct

42) Page 20. Fig 11 is referenced before Fig 10

43) Page 20. Line 23. Intead of explaning the cause of lower FRP, just say that it was because lower FRP, and usesection 3.1 to explain why FRP was lower in this retrieval

44) Fig 10. It is not clear what you are plotting in c. Are these emissions (y axis legend reads tons)? How would you obtain emissions from IASI? The caption is very confusing, please rephrase.

45) Page 21, Lines 13 – end of section. This belongs to the methods section.

46) Page 22, lines 4. "However, WF_ABBA and LSA SAF tend to be quite lower. . .."

47) Page 23, Line 3 what do you mean by "low intense fire activity"? Sounds like a contradiction.

References

Levy, R. C., Remer, L. A., Mattoo, S., Vermote, E. F., and Kaufman, Y. J.: Second-

generation operational algorithm: Retrieval of aerosol properties over land from inversion of Moderate Resolution Imaging Spectroradiometer spectral reflectance, Journal of Geophysical Research, 112, D13211, 2007.

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