Atmos. Chem. Phys. Discuss., 10, C7468–C7472, 2010
www.atmos-chem-phys-discuss.net/10/C7468/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on " Smoke injection heights from agricultural burning in Eastern Europe as seen by CALIPSO" *by* V. Amiridis et al.

Anonymous Referee #2

Received and published: 13 September 2010

General comments

This paper deals with a data-only analysis of biomass burning emission heights. Several sources of data are used

1. CALIOP aerosol heights
2. MODIS fire radiative power
3. ECMWF winds and boundary layer heights

The main results are that (i) a substantial amount of plumes penetrates the boundary layer height diagnosed by the ECMWF (ii) a relation exists between Fire Radiative Power and smoke plume injection height. These results are interesting for a broad public. However, I miss a detailed discussion about the relation between this work and other work (e.g. Val Martin, 2010). Moreover, figure 6 calls for additional analysis. Finally, I think that the reference to the CALIPSO level 2 products should be removed from the paper. It serves no purpose and the authors decided to use their own method based on the level 1 data, in combination with a smoothing algorithm. This smoothing algorithm cannot be applied to the level 2 data (how to smooth aerosol layers?) so the authors should better spend the space to explain their smoothing algorithm, which seems rather arbitrary. These three points should be addressed in the final ACP paper.

Minor comments

page 19250 line 22: CALIPSO lidar show a.....studies. Sentence can be removed.

page 19252 line 15: ..that **was** launched...

page 19253 line 2: CALIPSO produces Level 1 and Level 2 scientific data products. CALIPSO is the instrument, and scientific products are generated by algorithms or people. Please rephrase.

page 19253 line 7: **The** CAPILSO level-2 aerosol. I think that a detailed description can be left out here. Just mention that you use the level 1 data (see main comment above).

page 19254 line 4: This seems logical. It is better to explain here that the ECMWF mixing layer depth at 12 UTC is closest to the measurements. Also explain that this might result in a bias, since normally the boundary layer develops further in the 10:00 UTC to 12:00 UTC time frame. Also, the ECMWF mixing layer height is just a model

value, and validation efforts show that the mixing layer depth is not the best represented quantity in the ECMWF model.

page 19254 line 7: The bulk ...conditions. Sentence unclear, please rephrase.

page 19255 line 15: The numbers can be given with less accuracy (e.g. 11 to 439) and the unit should be MW per square kilometre I think. Correct this throughout the document and also add the unit to figure 6.

page 19255 line 20-26: Following .....to 5. I do not see the relevance for this paper and suggest to remove these sentences.

page 19256 line 7 and further: ECMWF has a surface wind product, which is much more relevant than the 850 hPa winds. Also, to show that fires are ignited only with low wind speeds, you should compare winds with fires to winds without fires. Now we have to rely on your classification: "These data indicate weak to moderate horizontal winds...".

page 19256 line 14: Thus, ...to the atmosphere. This analysis is too easy. First, it is based on the 850 hPa winds and not on surface winds. Furthermore, wind and wind shear may play an important role in heat dispersion of the plumes. So, the poor relation between intense fires and injection heights in figure 6 may have to do with wind (although you briefly mention later that there is no relation). Since you have access to ECMWF data, a straightforward analysis would be to analyse wind and stability profiles for all the fires. This connects also to the Val Martin paper (2010), who presented a more mechanistic analysis of plume rise.

page 19256 line 17: I suggest to rewrite this paragraph. Now there seems to be a conflict between "not easy to implement" and "The method is very simple". The need for smoothing in the horizontal and vertical is not well explained. Moreover the discussion of the CALIPSO level 2 products is not necessary. Since you apply horizontal and vertical smoothing, I do not see how you can compare to the level 2 product in figure

3. Still you say at line 12 in page 19258: "...is not consistent with the attenuated backscatter profile..."; and "After the demonstration of the cases that CALIPSO level 2 product fails to estimate top layer height...". This comparison does not add much to the paper and the arguments are not very strong either. Better explain your smoothing is relation to the horizontal dispersion of the plume. This sounds as a difficult problem to me, since the CALIPSO instrument crosses at high speed with a tiny footprint. Figure 4 and discussion can also be removed for the same reasons.

page 19260, line 1: Say something about the correction you applied for orography (and the general lack of orography in the region in general).

page 19260, line 23: Please report units for FRP.

page 19261, line 8 and further: This is pure speculation. A more detailed analysis is required here. You have access to ECMWF data and you can verify under which circumstances meteorological factors might dominate. The most simple approach is to filter the data for specific atmospheric conditions (e.g. very (un)stable temperature profiles, very windy days) and to redo the analysis on the filtered data. You mention somewhere that "no significant anticorrelation between horizontal wind speed (at 850 hPa!) and injection heights is revealed. Extend this analysis to thermal stratification. Also the fact that the FRP from MODIS cannot be trusted due to dense smoke clouds sounds like a weak argument, since obscured fires would have an underestimated FRP, which makes the situation analysed in figure 6 only worse.

page 19261, line 20: In both figure 7 left and 7 right: replace by something like: In both panels of figure 7..

page 19261, line 29: Mention that the satellite overpass is always earlier, and that the boundary layer height is usually still growing from 10:30 to 12:00 UTC (possible bias).

page 19262, line 27: 3.0 km for the 17.3 .....remove "the".

page 19264, line 17: CALIPSO lidar show....studies. Remove sentence.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 19247, 2010.