Editors comment paper acp-2017-692 by Collaud Coen et al.; The topography contribution to the influence of the atmospheric boundary layer at high altitude stations; now changed to "The topography contribution to the influence of the aerosol layer at high altitude stations"

Dear author, co-authors,

It has taken quite some extra time to come to the point of sharing an editor's comment with you. The last round of feedback was provided halfway April and you have then submitted your response and last revision the 7th of May. Sorry for this > 1 month delay in my action upon this last submission but have been busy with work related travelling in May and last week's being out of office dealing with personal issues.

We are now at the stage that the one of the reviewers is satisfied with your responses and the revisions that have been made in the manuscripts in some iterations. However, the second reviewer still had some significant criticism and comments regarding your last revision and the response to the provided reviews. I have been going through all the files including the last review and your last response and the revised document. Based on this I invited the reviewer to indicate if this last round of revisions and your response has properly addressed the concerns/issues of the earlier version of the manuscript. In addition, reading over again the ms I still came across quite some statements, sentences that I had to read over again also not always being convinced that these were correct regarding grammar but also not always optimally expressing that what you would like to express. Below, you can find these points that came across and that also need to be further addressed in another revision. I recommend you to ask one of the native English speaking co-authors to carefully check once more again the whole documents for the text to remove these flaws.

Overall, given the significant feedback and required revisions of the ms, it has been so far challenging to keep carefully track of all the changes but hope that at the end all this feedback and the revisions will ultimately result in a strongly improved version of the paper.

Regards, Laurens Ganzeveld

Major and minor comments:

Title; you have changed the title also considering the changes introduced in the ms based on the reviewers comments. However, this changed title is also according to me still not optimally covering the actual contents of the paper; especially the use of the term aerosol layer is not reflecting the contents. The suggested change in title by one of the reviewers seems to cover much better the actual content. Your study focuses on identifying the influence of topography on aerosol measurements at high-altitude stations. In addition, it seems that have not tackled the issue of the reviewer on the use of global modelling products to also assess the role of topography in aerosol properties at higher elevations. I am myself not so convinced that the resolution is already sufficiently high to indeed use model products for this, at least not from global models. There are though meso-scale models that can resolve some of the fine-scale meteorological features at resolutions down to some km scale (e.g., WRF). My point is that you should at least address this remark by the reviewer even if at the end

you decide not to include this aspect in your paper.

Page 6, line “non-GIS environment(Schwanghart and Scherler, 2014)” put space there.

Page 6; line 20: “Based on these criteria, the red station on Fig. 2 will be less influenced by the ABL…”, alternative; “Based on these criteria it can be inferred from Figure 2 that the “red” station will be less influenced by the ABL….

Page 7, line 2: “have hypso% *values* larger than 50%.”

Page 7, you refer in line 16 for example to small spatial scale and in the definition of the previous criteria to large spatial scale; here it is essential to indicate (again) what you deem being a small and a large spatial scale.

Page 7; line 23, what do you mean with “and there are some steps for CHC and BEO”, what steps ? and steps of what size?

Page 9: line 26: “PYR (5079 m) is the second highest station considered here, but..”, reading this section and statement this line was confusing since the term “here” suggests that this is referring to the second highest station of this case study. You mean here that PYR is the second highest stations of all stations considered in the study and would then also state it this way for clarity.
Page 10, line 2: “The ABL-TopoIndex depends on the size of the chosen domain (Fig. 6a) so that the various algorithms were tested to several domain sizes ranging from 50 to 1000 km2. The gradient G8 and the local slope LocSlope are calculated on small fixed horizontal scales (0.5-1 and 10 km, respectively)”. I had to read these two sentences a couple of times also not being convinced that this is the most optimal way to express what you intent to say. There are actually more of these sentences in the ms and would anyhow propose to still have once a native speaking English co-author (I guess there is one given the large list of co-authors) to critically check the ms for such potential flaws. Alternative: “Since the ABL-TopoIndex depends on the size of the chosen domain (Fig. 6a) we have conducted an evaluation of the sensitivity of the various algorithms to the domain size using a range from 50 to 1000 km2. The gradient criterion G8 and the local slope criterion LocSlope are calculated on small fixed horizontal scales (0.5-1 and 10 km, respectively)”

Page 10: line 9: “the concentration of thermally lifted pollutants”

Page 10, line 9/10: “The hypso% decreases continuously for stations situated in a dominant position in their mountainous massif such as JFJ, SBO or BEO (Fig. 6c)”. This is another example of a sentence that should be read carefully and revised. “continuously” here expresses something like over time whereas you want to express here that this parameter increases with an increase in the domain size.

Line 15: “with domain size”, change to “with an increase in domain size”

Page 10; line 23-24 “To compare these two parameters, we show in Fig. 7 the ABL-TopoIndex as a function of the altitude for all grid cells in a 5km x 5km domain

around a selection of stations"

Page 10; line 26: "..very steep and ASK a very flatt ABL-TopoIndex decrease with altitude"; first of all "flat", then secondly, what is a flat decrease?? I guess you would like to say that there is a strong increase and a small decrease or?

Line 33: "were constructed", alternative "are located"

Page 11: line 6: "are grouped on Fig. 8": are grouped as shown in Fig. 8 (change all this consistently in the text, e.g. "on Fig. 9"

Page 12, line 10: "their proximity *to* other massifs such as the Alps"

Page 14, line 14-15: "…ABL influence, in case of lifting processes without precipitation, is found for the ABL-TopoIndex…."

Page 14; line 18-19: "(mean ~~the~~ altitude over the 9 grid cells, similarly to the ABL-TopoIndex calculation)"

Page 15, line 12, "lowest and the greatest monthly amplitudes", should be according to me "smallest and largest monthly amplitudes", also check further the ms for this: e.g. "the greatest ABL influence" should be "the largest ABL influence" (possibly a matter of taste). You use many times the term greater it should be larger/largest or higher/highest, e.g. "higher correlations"

Page 15, line 21: "diurnal cycle minimal and maximal strengths of the absorption coefficient". This expression reads also not well. You figure caption text seems to express it in the proper way, modify this text.

Page 16, line 6: "First the possible species and phenomena enabling the estimation of the ABL influence", what do you mean here with species?? Do you refer here to compounds. I also think you generally want to refer here more generally to "parameters"

Page 16, line 27, "NOy" y lowercase

Page 16, line 28: "should be in most cases"; "could be in most cases"

Page 16, line 29 "hence involving aerosol washout"

Page 17: line 4-5: Your statement about using a model to further assess how pollutants can be used as a proxy for BL influence reads weird: what do you mean with a thermodynamic model? "…bounded to a 3D thermodynamic model adapted to complex topographies would be required before using absolute pollutant concentrations as indicators of ABL influence at high altitude sites", rather "..constraining simulations with meteorological models able to explicitly resolve the role of fine resolution orography would be …." (see also my previous comment on the title/introduction and first major comment of the reviewer).

In addition, this text is part of your modification of the ms responding another major

comment provided by one of the reviewers. There is another part of this modification that raises quite some questions: " A further use of DBinv to restrict the area of potential pollution sources could also be envisaged since this parameter describes the domain from which pollutants can reach the high altitude station by convection and without crossing topographical barriers. This delicate issue can however be avoided by instead considering dynamical parameters such as the various temporal cycles". What is delicate here? What are the dynamical parameters? You mention here the temporal cycles (diurnal and seasonal?) but in what parameters. I wonder what the reviewer will express about this modification. I am myself not very convinced and consequently suggest you to check this once more again carefully.

Page 17: line 14-15: " Usually the spring leads to higher aerosol loading than the autumn probably related to higher ABL height in the spring"; do you refer here to a higher aerosol loading/concentrations at the high-altitude stations?? I don't see how a deeper ABL would result in a higher aerosol loading in the ABL, actually the opposite would be expected not having any changes in the sources (more dilution)

Page 18: line 7: "has similar dependency as the ABL as a function of latitude", dependency on what? I know that in the following sentences you give examples but rephrase this sentence.

Page 18, line 16-17: "modify the theoretical cycles and lead to a broadening of the time of the extrema. These difficulties make obtaining clear statistical cycles another reason contributing to the observed low correlations", this text is another example of statements that need definitely to be rephrased. What are theoretical cycles: cycles that you would anticipate based on basic theory? What is meant with a broadening of the time? It would be broadening the time frame or increasing the duration, and which extrema?? And the second sentence needs complete revision.

Page 18, line 26- 27: Correlation between topography and aerosol parameters and "in Sect. 3.5"

Page 19, line 22-23: "Globally, NPF is the reason why the greatest correlations are found with the 50 percentile of the number concentration, instead of with the 5 percentile found for the absorption and scattering coefficients", also this sentence needs to be rewritten: correlations with?

Page 20, line 7,when you mention these terms "the Efremov-Krcho classification, the hypsometric curve" you should shortly explain them but also indicate why you considered to include these terms in the analysis. On the other hand, the discussion is already now (way too) long.

Page 20, line 28: "It is …"

References to "de Wekker" should be listed in the references under the "D" and not the "W" references.

Figure 1: the station names with the different colors come out sometimes quite poorly, like the stations in the US. Use only or white or black characters?