

## ***Interactive comment on “The topography contribution to the influence of the atmospheric boundary layer at high altitude stations” by Martine Collaud Coen et al.***

### **Anonymous Referee #1**

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This paper presents five metrics that can help quantify the boundary layer impact at high altitude stations. The metrics are based on topographic data and provide information on topographic characteristics including steepness, height difference between station and adjacent valley, and size of the drainage basin. The metrics are calculated for large number of stations. The focus in this paper is on a subset of these stations where aerosol measurements are made.

Overall, I think that the paper is a decent contribution to the scientific literature. The novel part is the quantification of the topographic characteristics surrounding a high altitude stations. The contribution of certain topographic characteristic to trace gas

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measurements at these stations is often speculated and discussed and it is nice to see a paper where where an attempt is made to quantify the characteristics. I am not sure though how useful the characterization of the topography as done in the current study will be for future studies/site planning. I found it rather surprising that correlations between topography parameters and the diurnal cycle are weak. Some findings of the paper require more clarification/explanation. I have a few comments that I list below.

1) the choice of the five metrics appears somewhat subjective. At some point in the manuscript (section 4.3) it is stated that "Several other parameters such as the topographical wetness index, the catchment area, the accumulation, dispersion and transit percentages, the hypsometric index and the prominence were tested but were finally eliminated as being not relevant for various reasons." . It remains rather vague why these parameters were eliminated. It would be good if the authors could make a list (e.g, in a table) of all the relevant parameters that the "TopoToolBox" produces and then also clarify what exactly was done to come up with the final five parameters.

2) How are the parameters produced by TopoToolBox similar to or different from the more widely used ArcGis software packages? many people who would like to apply the concept of a topographic index may be familiar with ArcGis software packages so a way to make the concept more widely used is to explain how these parameters could be calculated using ArcGis software.

3) page 3, line 30/31: Free convection cannot be driven by forced mechanical convection. This sentence is technically incorrect.

4) section 2.3, line 13: It should be explained here why a domain size of 750x750 km was chosen. The authors discuss somewhat later in the manuscript the sensitivity to domain size but a justification for the chosen domain size should be provided here. The domain size currently sounds rather arbitrary.

5) page 7, line 6: "with the size of the local scale depending on latitude". Please explain/expand.

6) page 8, line 18: use plural "autocorrelations". Also on next line, "auto-correlations" is hyphenated. Find out how it needs to be written and be consistent.

7) page 17, line 6/7: "Usually the spring leads to higher concentration of ABL species than the autumn". Why?

8) page 18, line 14/15: Please explain why absorption coefficient is "the best tracer for anthropogenic pollution and biomass burning and consequently of ABL influence.". Unclear to me.

9) page 19, line 8: "by the smoother pressure decrease". I don't understand that explanation. Please clarify.

10) page 20, line 1: "and at all altitudes" awkward phrase. Rephrase sentence.

11) page 19, line 11: "There are consequently few correlations between topography parameters and the diurnal cycles". This is an important finding that should be explained better in this section. Does this imply that investigators trying to discuss diurnal cycles at high altitude locations waste their time by trying to find any correlation with topography? Please discuss this better.

12) Figure 3 caption, line 5: "horizontal" should be "vertical" here, I think.

13) Figure 11, caption: "Calculations corresponding to the various domain sizes can be identified by the various flow paths lengths.". I don't understand how the calculations can be identified. Please clarify.

14) Figure 12 caption. "similar to Fig. 8". I don't see how this is similar to Fig. 8.

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