

Interactive comment on “Investigation of nucleation events vertical extent: a long term study at two different altitude sites” by J. Boulon et al.

Anonymous Referee #3

Received and published: 5 May 2011

Review on Boulon et al.

General

The paper is focused on a very interesting and still not well investigated topic: new particle formation in higher altitudes. So far, those studies were limited to a few airborne campaigns, but of course mountain sites give the opportunity for long-term studies. However, measurements at a mountain site at e.g. 1500 m height are not completely comparable with airborne measurements in the same altitude, because vertical mixing is definitely different around a mountain. If this will be taken into account the data might be very useful to understand the occurrence of new particle formation in different

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altitudes. The paper is generally clearly written, but contains a number of typos and should be checked and corrected in detail.

Comments in detail:

Introduction:

The terms new particle formation and nucleation are both used here. What is the definition of new particle formation here? Nucleation is only part of the NPF process and should not be used as a synonym. The authors should very clearly define these terms and use them carefully.

There is definitely a difference between measurements on a mountain and airborne measurements in a similar altitude. All vertical mixing processes are of course influenced by the topography, i.e. the mountain. This should be mentioned in the introduction and discussed later. Such measurements on a mountain are the only way to realize long term measurements in high altitudes but cannot fully replace airborne measurements.

Measurement sites:

The climatic conditions should be described in more detail. Only winter temperatures are mentioned, what's about summer?

Figure 1 should be better explained, in the color plot the unit of height is missing, the labels on the axes are mostly too small.

Particle measurement devices:

The PdD station is explained in detail but I did not find anything about the measurement technique at Opme. Please explain the instrumentation at both sites.

Lidar measurements:

Water-vapor-to-dry-air mixing ratio can be named much shorter: water vapor mixing

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ratio means the same and is more commonly used in atmospheric science.

The acronym FT has not been explained so far. Of course, most readers know it but it should be introduced again (or I did not see it..).

I do not really understand the procedure to obtain the PBL height. The figure does not help much without any explanation. A more detailed figure caption should be given.

What is an injection layer? I never heard this word before. If you really want to use this term, please define what it means. It is not commonly known.

Results:

Page 8257, line 12, please explain 'particular local environment'

Page 8258, lines 2 – 5, there are some numbers given with uncertainties, such as formation rates for charged and neutral particles as 0.071 ± 0.087 : I think, 3 decimal digits are not reasonable in this context. Please rethink the number of digits given here!

Page 8259, line 16/17: What do you mean by 'the model cannot describe local air mass motion such as topographical effects. . .' I think the model contains information about topography.

Page 8260, line 19: The acronym 'PdD' was used for the first time here? If yes, it should be defined.

Figure 5: the labels are too small and the quality of the figure might be improved. What is shown there? The caption says negatively charged particle size distributions and particle size distributions. . . .

Page 8261, line 24: What do you mean by cloud presence? Simply clouds yes or no, means if the station was in-cloud or not? Or anything else?

Page 8263 line 12: what is meant by: the presence of condensing vapours is less a limiting factor. . . This sentence should be rewritten in a clearer form.

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Page 8264, line 12 .. when the nucleation is onset. This is not a correct sentence to my understanding, please rewrite.

Page 8264, line 17 Where are the values for the nucleation period? I do not see it in the figure 8?

What do you mean by 'same atmospheric layer'? The development of the boundary layer should be discussed here in more detail. I think, differences between the two sites are strongly connected with differences regarding the PBL, i.e. if the station is within the mixed layer or above. I think this is the key for any difference.

Page 8265, line 25 What do you mean by:..change in atmospheric properties.. Please clarify!

It would be great to see if the occurrence of nucleation events at both sites depends on the season, i.e. the typical boundary layer height. This should be discussed by the authors as well.

Conclusions

First, this is more a summary and this should be mentioned in the caption. What numbers are given here? Mean + stdev? Or error? This should be explained, maybe also earlier. Again, the given accuracy here is not reasonable, e.g. a boundary layer height of 1453 ± 520 .

Here, also the relation to the boundary layer development should be discussed. This is really important to understand the variation at a high altitude site. Furthermore, the special case of a mountain site in relation to airborne measurements should be mentioned and discussed. NPF processes occurring at e.g. inversion layers cannot be studied at mountain sites.

Page 8268, line 20/22 and later: nucleation should be replaced by new particle formation. In fact, nucleation is not really observed here, because this is just the first step and influences the very small particles only.

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Page 8268, line 7: talking about atmospheric composition is a bit challenging for the presented study, because there are not many measurements available. This should be clearly stated. Reading atmospheric composition I expect very detailed measurement of chemical species.

There should be a bit more discussion. Why is the NPF more frequent at the high altitude site? At least some speculation should be possible. This is really necessary to do because otherwise the conclusions contain mainly a description and summary.

Figures:

Figure 2: From the figures I do not understand the method at all. In the caption a bit more explanation should be given (as well as in the text, see above).

Technical (I used the line numbers given in the manuscript, sometimes they seem to be in a wrong order..)

Typos and grammar and other technical corrections (probably among others, a spell checker would help a lot):

Page 8251, line 2: ultrafine

Page 8251, line 22: Cabauw

Page 8251, line 28: equipped

Page 8254, line 4 particle (without 's')

Page 8254, line 5 measurements (with 's')

Page 8255, line 6 developed

Page 8255, line 8 tries instead of try

Page 8255, line 10+11 regime

Page 8255, line 23 particles (with 's')

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Page 8256, line 3 identified instead of identify

Page 8256, line 7 explanations (with 's')

Page 8257, line 3 . . . vapours and (ii) the particle..

Page 8257, line 6 indicates (with 's')

Page 8257, line 7 vapour (without 's')

Page 8257, line 23 'f' should be written italic

Page 8258, line 2 rates (with 's')

Page 8258, line 5 ions (with 's')

Page 8258, line 28 sulfuric

Page 8258, line 29 parameterizations

Page 8259, line 3 concentration (without 's')

Page 8259, line 16 'of' should be deleted

Page 8259, line 19 'of' should be 'on'

Page 8259, line 20 geographical destinations such as African start with a capital, this should be corrected also in the following paragraph

Page 8260, last line: 'formation' should be added between particle and formation

Page 8261, line 5 compared

Page 8263, line 9 (first line on the page) parameters (with 's')

Page 8263, line 16 events (with 's')

Page 8263, line 22 each other (separated)

Page 8263, line 25 . . . it was estimated to . . .

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Page 8263, line 2 in terms (with 's')

Page 8264, line 10 in terms (with 's')

Page 8264, line 24 inhomogeneous (instead of unhomogeneous)

Page 8264, line 25 conditions (with 's')

Page 8264, line 1 (4 lines before line 5) does instead of do

Page 8264, line 2 hypotheses (plural)

Page 8264, line 4 have instead of has

Page 8264, line 6 the high altitude site

Page 8264, line 7 is the most probably one.

Page 8267, line 19 does instead of do

Page 8267, line 22 sites (with 's')

Page 8268, line 12 developed (only one 'p')

Page 8268, line 24 autumn

Page 8268, line 25 rate (not arte)

Page 8268, line 4 calculated

Page 8269, line 15 do should be does

Page 8269, line 17 influenced

There is also a number of typos and grammar mistakes in the figure captions, they should be checked carefully as well.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 8249, 2011.

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