

Interactive comment on “Aerosol nucleation spikes in the planetary boundary layer” by J.-P. Chen et al.

Anonymous Referee #1

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Statement for the article aerosol nucleation spikes in the planetary boundary layer by J.-P. Chen and co-authors.

This article presents an interesting theoretical study to explain peaks in the nucleation mode, phenomena which has been observed at several places around the world. The authors point out in their study that eddy-induced nucleation and the rapidly change in incoming solar radiation resulting from blocking of actinic flux by scattered clouds could be partly responsible. The paper is clear written and easy to understand and should be published in ACP after the following minor comments have to be considered.

Comments:

I was very interested in reading this paper and the idea behind sounds logical. How-

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ever, also this is a theoretical study and the production of the nucleation rates or the nucleation theory is not the main goal of the paper I cannot understand how the model with a sulfuric acid based binary nucleation can reach this high nucleation rates with values up 1000 and higher. I would like to see at least some more numbers concerning the assumed sulfuric acid concentrations in the model runs. Keeping this as a theoretical study with the focus on explaining the peaks it should be clearly pointed out that a lot of simplifications like e.g. the missing effect in the particle growth by organic vapors in the aerosol dynamic have been assumed.

The definition of fresh particles by particles below 30 nm is critical. The authors never mention any growth rates although they should get the data from their measurements easily. Assuming an average growth rate of 5-10 nm per hour the so called fresh particles are at least 3 hours old. By discussing the effect of turbulence I'm a little surprised that the model run show such a strong influence on the particles above 10 nm. If the authors only take sulfuric acid to grow the particles I wonder how this could fit and this is a second reason to see the assumed sulfuric acid concentrations. This is a little bit difficult to follow because we know from many publications that sulfuric acid only contributes a small fraction of the particle growth. Anyway the aim of the study is not on the growth mechanism but it should be clarified otherwise readers would be completely lost. By ignoring organic molecules in your theoretical study you have to inform the reader that this will not have a strong effect on the peak appearance but was kept simplified in this manuscript.

One aspect I do not like in the article is that the authors in some parts of the paper not using the well-defined definitions for particles but create their own. This is done at several places in the manuscript and I can only advice the authors to change it so the text will be easier to understand. E.g. page 26933 line 9: nuclei mode - > nucleation mode; line 10: old particles -> pre-existing particles;

All figures are very difficult to view because of too small fonts used.

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In figure 1 and 6 the text should be corrected after using colors.

Figure 6a and 6b should have the same time period from 11 to 12.

I would also like to see the temperature change in the air parcel added in figure 6a.

Page 26934 line 26: requires -> required

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 26931, 2010.

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