

Interactive comment on “Roll vortices induce new particle formation bursts in the planetary boundary layer” by Janne Lampilahti et al.

Anonymous Referee #1

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This paper describes the influence of BL dynamics induced by roll vortices on new particle formation. To do so, the authors used a large data set issued from ground-based and aboard instruments devoted to Ultra-Fine Particles (UFP) particle size distribution measurements (Particle magnifier, NAIS, DMPS) and wind measurements. They found that roll induced events are numerous over the boreal forest and need to be well simulated to better understand nucleation processes within the atmosphere.

Major comments

1. Measurement average : All measurements are performed at different frequency and the authors choose to average all the data over different periods (4 min, 12 min, 30min). They did not justify why they choose these periods. Why not using the same periods for all instruments ? The DMPS SD are not averaged what was the frequency

for this instrument ?

2. Measurement location : Could you please justify that inlet height differences are unnoticeable on aerosol measurements ? Especially, when you used the synergy between anemometer at 125m above the ground with a CPC at 23m.

3. In general the figure labels are really long because you explained most of the time the way you used to process the data. I found it odd, especially because you are limited in word numbers. For example, I have many questions about Figure 9. From what I understood, figure 9 shows size distribution and formation rate calculations based on observations of geometric mean diameter.

- First of all, geometric mean diameter given in table 3 is observed at the end of the event, an hour after the beginning ? This is not clearly stated when the D_p values refer to.

- Then you use a constant GR of 1.9nm/h. Why ? You have measured the GR for each case. Then why using this value corresponding to GR from days that showed multiple subsequent roll-induced NPF events ? According to Table 3, the GR ranges from 0.8 to 4.3 nm/h. The use of GR value 2 times lower or larger might causes a lot of difference in the diameter growth and the formation rate.

- Moreover, I don't understand the last sentence : "We then used random sampling (1000 samples), also varying the GR, to estimate 25th, 50th and 75th percentile values for the formation rates of 3- and 10-nm-sized particles". From this sentence, one can understand that the GR is not fixed anymore. What are the values used then ??? Also, you used 1000 random samples from what you calculated. Do you have 1000 samples from what you calculated ? You have 3 (GR variations ?) * One SD/hour * nb of events (46) or did I miss something ?

- How do you control this random factor ? Could the 1000 samples belongs to one or 2 specific events ? If the GR is two times larger, what will be the error on the formation

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rate.

- And so you did all that to get formation rates that you measured directly ???

4. Fraction of area : So you use a ratio of two periods and that give you a fraction area covered by the roll-induced NPF. Could you please explain the idea behind it ? I guess that this is related to the wind speed of the air mass over the site vs over the region. So, assuming both wind speeds are similar this is just a ratio of the horizontal extend of the NPF event when passing over the site and the horizontal extend of the NPF observed by the airborne instruments.

What is the time shift between the aboard and grounded measurements ?

Is the wind speed really constant during the whole period ?

Minor remarks

L161 – 171 : You could probably use figure 10 to ease the understanding. It would be useful !

L176 : “Organized convection causes the insects to congregate due to the lower BL convergence related to the updraft zones. The number density of insects in the updraft zone is probably further increased by the insects’ tendency to resist upward motion to lower temperatures, adiabatic cooling of the rising air.”

Please rephrase these two sentences. I think there are many ideas in there but need to be further explained. Personally, I don’t know anything about insects and this is hard to link it to the dynamics you seemed to describe.

L 225 : induced not induced

Figure 8 : These two figures are pretty interesting but I think that you need the reader to understand what you show. So here there are apparently 2 event types : One regional and one induced by roll vortices. Looking at Figure 5b, I see several zones associated with high N3-20. One in the 4 first km north to SMEAR II mast and the second one is

further north (12km). According to wind speed direction the one located further north did not cross the site measurement. So my question is how could you separate the Roll vortices induced NPF from the regional one given the fact that both are located in the same zone ? If you used only the mean geometrical diameter, could you please justify why this is relevant ???

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