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Atmospheric Chemistry and Physics Discussions

Interactive comment on "New insights into nocturnal nucleation" *by* I. K. Ortega et al.

Anonymous Referee #2

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General comments:

New particle formation is an important source of atmospheric aerosols. This study explains the formation mechanisms of unusual night-time nucleation events by combing field observations, chamber simulation experiments, and model calculations. These results significantly contribute to the open questions in the nocturnal new particle formation. It is well-written manuscript. I have several comments that should be considered before publishing in ACP.

Major comments:

1. The reactions of monoterpenes with ozone have already received considerable attention with regard to their reaction kinetics and reaction products during the past years. The highlight of this study is to focus on the role of these reactions in the nocturnal nucleation events, especially occurred at Tumbarumba in Australia. The authors

may emphasize that, to which extent, your chamber experiments is relevant to the atmospheric conditions under which nocturnal nucleation events took place. A summary of atmospheric conditions, such as, relative humidity (RH), temperature, ozone concentration, preexisting particles concentration, and VOCs concentration during nocturnal nucleation events would be helpful if these data are available. I noted that temperature of set 1 experiment is around 30 C, and RH is below 30%. Actually, the reaction conditions are far away from the night-time atmospheric conditions.

2. The discussions regarding the ozone trigger level are unclear. As shown in Fig. 1, the concentrations of monoterpenes are quite different for each experiment when the events started. This may also result in different ozone trigger level. In my understanding, the trigger levels are identified based on the particle number concentration. This means that the ozone trigger levels are not only related with the gas-phase reactions and also with the properties of the oxidation products in particle phase (such as their vapor pressure and concentrations). More explanations are needed here.

3. NO3 radical is also an important night-time oxidant. Based on the reaction rate of NO3 and monoterpenes, the reaction occurs easier than ozonolysis of monoterpenes. The authors may explain why this study solely utilized the ozonolysis of monoterpenes to simulate the night-time nucleation events without taking into account NO3 radical. Or, there are some evidences that NO3 radical at Tumbarumba is not very important.

Minor comments:

1. Fig. 1, it is better to use the same x-axis scale in all plots and mark the time when the nucleation events started.

2. Section 3.2, Line 10-14, Page 31333, the conclusions "The shape of these events were dependent on (i)…., (ii)" are drawn based on field observations or chamber experiments? Please clarify it.

3. Line 27-28, page 31332, any influence of particle loss in the chamber on the total

particle number concentration?

4. Please correct the x-axis tick labels of Fig. 7 panel (d).

5. Table 2, what is the “b.d.”?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 31323, 2011.