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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Particle formation and growth at five rural and urban sites" *by* C.-H. Jeong et al.

Anonymous Referee #2

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General comments

This study investigated ultrafine particle (UFP) formation and growth at 5 measurement sites (rural and urban) in south-western Ontario, Canada. The sites were separated by up to 350 km, which provided an excellent opportunity to investigate the spatial scale of regional nucleation events. Only a limited number of studies of regional nucleation events over comparably large spatial scales can be found in the literature, so this manuscript is a very welcome contribution to ACP. A large amount of quality data has been collected (particle number size distributions, SO2, meteorological data for all 5 sites) and interesting methods of analysis have been applied. In particular, the analysis of the spatial homogeneity of the regional nucleation events is interesting and well presented. However, the manuscript could still be significantly improved by further

extension of the data analyses, as explained below. The manuscript is well structured and the results are presented in a clear and concise manner. Therefore, following implementation of the changes suggested below I believe it is suitable for publication in ACP.

Specific comments

The authors clearly define a suitable scheme and classify the nucleation events observed at each of the 5 sites into classes I, II and N. They conclude from air mass back trajectory analyses that class I events are associated with cooler drier air from northern Ontario, class N (non-) events are associated with air masses that have passed over distant industrial regions to the south (e.g., Ohio River Valley), and that class II events are associated with high SO2 levels picked up from nearby industrialized regions (P 11637, L 2-6). However, not enough analysis is presented to support this conclusion. Air mass back trajectories are only shown for 3 days in total (1 day to represent each event class). I would recommend plotting event back trajectories of all class I, II and N nucleation events in a single figure, or combination figure similar to the current Fig. 7. This would allow the likely source regions for each of the nucleation event classes to be properly identified (if indeed specific source regions exist) and would justify the conclusions stated above.

Alternatively or perhaps in addition I would recommend including CPF plots for particles in the size range 14-25 nm, if possible separated into class I and II days. In a dedicated study of particle formation and growth I am not sure why the authors have only shown CPF plots for particles in the size range 14-100 nm (Fig. 4). CPF plots of nucleation mode particles would also allow new particle source regions to be identified, particularly for the class II events which appear to be related to local anthropogenic sources.

P 11616, L 20 (abstract) and P 11638, L 2 (conclusions): I am not sure on what basis this claim is made. It is suggested that class II events occur in anthropogenic

SO2 plumes and that class I events are possibly related to biogenic emissions from the north. Does particle formation in southern Ontario appear to be more related to anthropogenic rather than biogenic emissions because class II events occurred more frequently than class I events? If so the claim is dubious because class I events appear almost as common as class II events at the 3 near-border sites. This point needs to be discussed further in the text if it is to be presented as one of the main findings of the study in the abstract and conclusion.

P 11621, L 3: Comparison of what variable, concentration? Has the data presented in this manuscript (e.g. Table 2) been corrected for this difference?

P 11621, L 8: At all sites? This can be seen from Table 3 but it should be outlined explicitly in the methods section as well.

P 11627, L 13; P11629, L24: What is Environment Canada's determination of a lake breeze event? Can the authors provide a reference that explains this for readers not familiar with such events?

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 11615, 2010.