

Interactive comment on “Regional effect on urban atmospheric nucleation” by Imre Salma et al.

Anonymous Referee #3

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Particle nucleation continues to be a major topic of research. Although nucleation in polluted atmospheres may play a less important role in atmospheric and climate science than it plays in the remote atmosphere, it can still have an important influence on particle size distributions and a major impact upon airborne concentrations of nanoparticles. This paper makes an interesting contribution by a careful analysis of nucleation events at two sites, one an urban site in Budapest and the other a rural site, K-puszta. The two sites are often connected by the wind trajectories, and the characteristics and relationship between nucleation events at the two sites are carefully intercompared. The work therefore allows an identification of conditions which favour nucleation at both sites simultaneously or at one site whilst not at the other. It therefore provides a useful contribution to the understanding of the determinants of the particle nucleation in a moderately polluted atmosphere. In this context it is worth noting that concentrations of sulphur dioxide and particulate matter in the measurement domain lie between those expected of remote rural locations and those occurring in the more polluted cities

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of the world.

The data analysis is thorough and the work appears to be conceptually sound. There is, however, a lack of adequate information on the measurements of atmospheric criteria pollutants which are used heavily in the data analysis. It is indicated that these came from the closest measurement stations to the sites at which the nucleation studies were conducted, but further information is needed on the relative locations of the air quality network stations, and if possible, evidence on the local sources are spatial variability of air pollutant concentrations. Since these data come from a National Air Quality Network, it is assumed that quality assurance processes are appropriate, but a reference to relevant documentation or its inclusion in supplementary information would be reassuring.

One of the hypotheses proposed is that some nucleation events at the K-puszta station were the result of oxidation of sulphur dioxide by stabilised Criegee intermediates, but the only evidence provided for this is an indication of increased ozone concentrations overnight before the nucleation events. As noted elsewhere in the paper, the higher ozone levels may be an indication of greater photochemical activity and could be associated with higher concentrations of hydroxyl radical. The formation of Criegee intermediates is dependent upon the oxidation of an alkene by ozone and no data are presented on the concentrations of alkenes. This process is invoked by the authors to explain some nucleation events at the K-puszta station but they do not consider the likely enhancement in anthropogenic alkenes at the Budapest site which offers a potential for formation of Criegee intermediates at that site also. Ozone concentrations measured at Budapest and K-puszta shown in Table 4 do not vary greatly and differences are smaller than in many urban/rural comparisons.

In addition to consideration of these points, there are two further recommendations. Firstly, the empirical relationship between the scaling factor k and GRad on page 3, line 34-35, requires units for GRad. Secondly, both the abstract (page 1, line 10) and the conclusions (page 9, lines 2-3) refer to the health risk associated with nanopar-

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ticle exposure. It is recommended that these references to health risk are removed. The body of evidence for health risks associated with airborne nanoparticle exposure remains relatively small and is not entirely coherent. It is also based very largely on urban environments dominated by traffic-generated nanoparticles and there is to date no evidence that the findings of these studies can necessarily be extrapolated to apply to nanoparticles deriving from atmospheric nucleation processes. Hence, the health impacts of particles nucleated in the European atmosphere remain a matter of conjecture.

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