Characteristics of new particle formation events in Hungarian background air at K-puszta, 2008-2012

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Fine aerosol particles have been studied in the last years due to their important role in several atmospheric processes and effects on climate and human health. New particle formation events are observed all over the world both in polluted and clean, background air. Similarly, in Hungary NPF events can be detected in polluted cities like Budapest (Salma *et al* (2011), Borsós *et al* (2012)) as well as in rural air at K-puszta (Yli-Juuti *et al* (2009)). Our former results showed that at K-puszta new particle formation (NPF) can be frequently observed, the number of NPF events peaked in spring and autumn (September) per each year.

In this work we summarize our results on the particle formation at K-puszta station between Nov. 2008 and Dec. 2012. The size distribution of the particles between 3-800 nm is evaluated. On the basis of DMPS spectra the classification of particle formation events is carried out according to the recommendations of Yli-Juuti *et al* (2009). The event classification is studied with respect to the seasonal variation and the frequency of the particle formation event types (event, non-event and unclassified) is also discussed.

Figure 1. Event classification statistics (2012), K-puszta.

Generally, our four year statistics on new particle formation (NPF) shows that winter is the most inactive period. In contrast the number of NPF events was found to be the highest in spring and in autumn as presented for 2012 (Figure 1). As a consequence of the above-mentioned seasonal variation of the NPF events, the frequency of the nucleation mode (3-25 nm) was the highest during spring and autumn (Figure 2). On the other hand, in winter the accumulation mode (100-800 nm) showed the highest, while in spring and summer the lowest frequency. This seasonality is also shown by the "typical" seasonal number size distributions. This means that in spring the freshly formed particles, while in winter the aged particles characterize the aerosol size distribution.

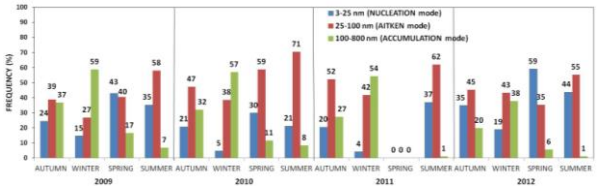

Figure 2. The seasonal frequency of the maximum concentrations in different particle modes (2009-2012).

The growth rate (GR) of the freshly formed particles is also calculated (Hirsikko *et al* (2005), Yli-Juuti *et al* (2009)). Our results on four-year data showed the high variability of particle GR with no significant seasonal variation at K-puszta. The rates were estimated between a few and 14 $nmhr^{-1}$ except some days with higher GR (between 16.5-18.41 $nmhr^{-1}$). The average GR was 5.85 $nmhr^{-1}$. On the other hand, the formation intensity of new nucleation mode particles (smaller than 25 nm) is also estimated. The calculation is based on the method considering the change of the particle number concentration in each size modes per unit time. The average formation rate for 10 nm particle size range was found between 0.33-46.31 particles $cm^{-3}sec^{-1}$.

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