Observation of new particle formation on Curonian Spit

G. Mordas, K. Plauškaitė, N. Prokopciuk, V. Dudoitis, and V. Ulevicius

State Research Institute Center for Physical Sciences and Technology, LT-02300 Vilnius, Lithuania

Keywords: new particle formation, nucleation, nanoparticles
Presenting author email: genrik.mordas@ftmc.lt

Annual observations of new particle formation (NPF) phenomena were carried out at the Preila station (55◦55′N, 21◦00′E, 5 m above sea level) located on Curonian Spit (Lithuania). The aerosol particle number concentration (PNC) and size distribution measurements (8.7-840 nm) were performed using a Scanning Mobility Particle Sizer model 19.3.09 IFT/TT (TROPOS, Leipzig, Germany),with automatic sheath flow, temperature and relative humidity control V2.6 TT 2006 and CPC UF-02M (Mordas et al, 2013).

The annual average total PNC was $3.9 \cdot 10^3$ cm^{-3}. The seasonal variations of the total PNC had a maximum monthly average in March ($6.3 \cdot 10^3$ cm^{-3}) and the minimum in November ($1.9 \cdot 10^3$ cm^{-3}). The highest input (44–64%) into the total PNC was influenced by Aitken mode particles (20–100 nm). The accumulation mode particles (100–840 nm) made up 23% during spring, summer and autumn months, and comprised about 48% during winter. Wherein, the input of the nucleation mode particles (8.7–20 nm) varied from 11% to 20%. However, the diurnal average input had higher variations, but were strongly limited by Aitken and accumulation mode inputs to the total PNC. It should be noted that the described limit lines and the determined empirical coefficients were the same for NPF event and non-event days. Physically, it means that a coagulation process of ultrafine particles and their precursors on the larger Aitken and accumulation mode particles determined the de-escalation of the nucleation process.

During whole year were observed 111 NPF events, which were classified as Class I (18 days) and Class II (93 days) by Dal Maso et al. (2005) NPF classification scheme. The higher number of the NPF events were accounted in March, April, June, November and December, and non-event days mostly occurred in January, February, May, September, November and December. Most of the long-term NPF events was observed when the air masses arrived from the northern directions (Scandinavia, the North Sea, and the Arctic), and, accordingly, the NPF in typically polluted continental air mass was observed very rarely.

The calculated new particle formation rate J_8 varied from 0.11 to 0.97 cm^3 s^{-1}, with the mean value of 0.45 cm^3 s^{-1}. The highest values of the particle formation rate were estimated for the springtime, and the lowest – for the wintertime. The growth rate of ultrafine particles (8-20 nm) varied from 1.7 to 6.4 nm h^{-1}, with mean value of 3.8 nm h^{-1}. The determined condensation sink varied from $7.40 \cdot 10^{-4}$ to $2.27 \cdot 10^{-3}$ s^{-1}with the average value of $1.53 \cdot 10^{-3}$ s^{-1}. Whereas the multilognormal estimation gave detail information about the dynamics of total PNC of each mode, a mode mean geometric diameter D_g and geometric standard deviation σ_g (Fig. 1).

The parameters estimated for the NPF events observed on Curonian Spit were partially similar to the Northern Europe stations. However, the PNC level, low seasonal PNC cycle and heterogeneous air masses showed similarity with Central Europe aerosol.

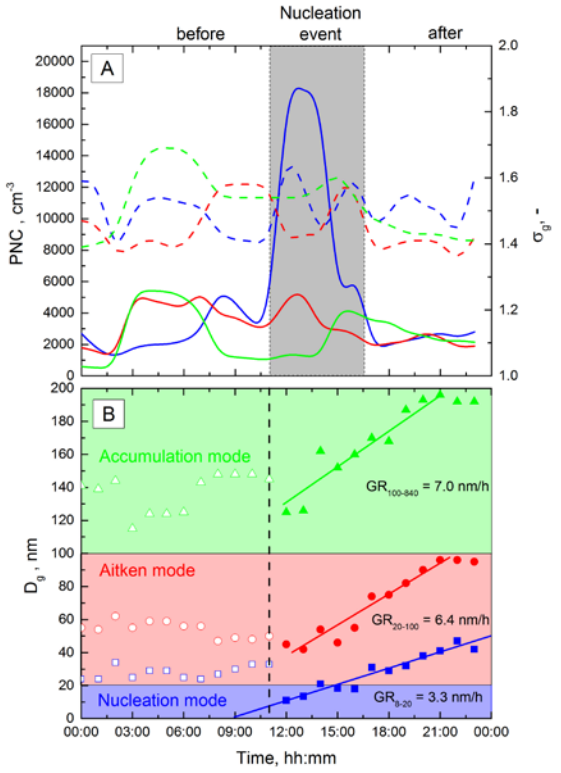

Figure 1. The multilognormal characterisation of the Class I type nucleation event.

This work was supported by the Lithuanian–Swiss Cooperation Programme “Research and Development” project AEROLIT (Nr. CH-3-ŠMM-01/08).

Dal Maso, M., Kulmala, M., Riipinen, I., Wagner, R., Hussein, T.,Aalto, P. P. and Lehtinen K. E.J. (2005). *Bor. Env. Res.*, **10**, *323–336.*

Mordas, G., Ulevicius, V, Plauškaitė, K. and Prokopčiuk N. (2013). *Lith. J. Phys.* **53**, *175–182.*