Geophysical Research Abstracts
Vol. 13, EGU2011-5582-2, 2011
EGU General Assembly 2011


# New particle formation events in the Siberian boreal zone

Mikhail Yu. Arshinov (1,2) and Boris D. Belan (1)

(1) V.E. Zuev Institute of Atmospheric Optics, SB RAS, Tomsk, Russian Federation (michael@iao.ru, +73822492086), (2) Tomsk State University, Tomsk, Russian Federation

One of the main problems relating to climate radiative forcing is associated with a low level of understanding of indirect effect of tropospheric aerosols. This problem is also complicated by a poor predictability of nucleation and new particle formation (NPF) events. The number concentration of newly formed particles in turn can increase the number of cloud condensation nuclei. It is known that nucleation is widely observed over forested regions (Mäkelä et al., 1997; Dal Maso et al., 2002, 2008). Siberia occupies the vast forested areas of the Northern Eurasia, but only a few literature data on ultrafine aerosol particles and their size distribution are available for this region (Bashurova et al., 1992; Koutsenogii and Jaenicke, 1994; Koutsenogii, 1997). The most detailed data on new particle formation and growth in the troposphere over Siberian forests were reported by Dal Maso et al. (2008).

In 2010, we started to carry out continuous measurements of atmospheric aerosols in a wide range of sizes in order to fill up this gap in data. Two devices are used for aerosol measurements. An automated diffusion battery (Ankilov et al., 2002a, 2002b) coupled with a TSI (TSI Inc., USA) Model 3781 Water-based Condensation Particle Counter (WCPC) measures the size distribution of aerosol nanoparticles in the size range of 3–200 nm and total number concentration of particles as well. The inversion algorithm of the ADB data to particle size distribution was developed by Eremenko and Ankilov (1995). When calculating size spectra the counting efficiency of ultrafine particles of the Model 3781 WCPC is taken into account. The GRIMM (Grimm Aerosol Technik GmbH & Co. KG, Germany) Model 1.109 Aerosol Spectrometer is used to detect and count aerosol particles in 31 size ranges from 0.25 to 32 $\mu$m.

One-year monitoring nearby Tomsk showed that new particle formation events in Siberia were more often observed during spring (from March to May) and autumn (secondary frequency peak in September). The most strong nucleation bursts occurred in April. The observed seasonal pattern of event frequencies is similar to one observed in Hyytiälä (Kulama et al., 2001). This fact reflects the similarity in the new particle formation processes occurred in the boreal forests of Sothern Finland and West Siberia. The highest formation and growth rates of ultrafine particles measured in Siberia reached values of 2.3 $cm^{-3}$ $s^{-1}$ and $\approx$25 nm $h^{-1}$ (in April) and 1.1 $cm^{-3}$ $s^{-1}$ and $\approx$9 nm $h^{-1}$ (in September), respectively.

This work was funded by Presidium of RAS (Program No 4), Brunch of Geology, Geophysics and Mining Sciences of RAS (Program No 5), Russian Foundation for Basic Research (grants No 11-05-00470 and 11-05-00516), and Ministry of Education and Science of Russia (State Contracts No 02.740.11.0674 and 14.740.11.0204).

Ankilov A., Baklanov A., Colhoun M., Enderle K.H., Gras J., Julanov Y., Kaller D., Lindner A., Lushnikov A.A., Mavliev R., McGovern F., O'Connor T.C., Podzimek J., Preining O., Reischl G.P., Rudolf R., Sem G.J., Szymanski W.W., Vrtala A.E., Wagner P.E., Winklmayr W. and Zagaynov V., 2002a, Particle size dependent response of aerosol counters, *Atmospheric Research* 62, 209–237.

Ankilov A., Baklanov A., Colhoun M., Enderle K.H., Gras J., Julanov Y., Kaller D., Lindner A., Lushnikov A.A., Mavliev R., McGovern F., Mirme A., O'Connor T.C., Podzimek J., Preining O., Reischl G.P., Rudolf R., Sem G.J., Szymanski W.W., Tamm E., Vrtala A.E., Wagner P.E., Winklmayr W. and Zagaynov V., (2002b), Intercomparison of number concentration measurements by various aerosol particle counters, *Atmospheric Research* 62, 177–207.

Bashurova V.S., Dreiling V., Hodger T.V., Jaenicke R., Koutsenogii K.P., Koutsenogii P.K., Kraemer M., Makarov V.I., Obolkin V.A., Potjomkin V.L. and Pusep A.Y., 1992. Measurements of Atmospheric Condensation Nuclei Size Distributions in Siberia. *Journal of Aerosol Science*, 23, 191-199.

Dal Maso, M., M. Kulmala, K. E. J. Lehtinen, J. M. Mäkelä, P. Aalto, and C. D. O'Dowd (2002), Condensation and coagulation sinks and formation of nucleation mode particles in coastal and boreal forest boundary layers, *J. Geophys. Res.*, 107(D19), 8097, doi:10.1029/2001JD001053.

Dal Maso M., Sogacheva L., Anisimov M. P., Arshinov M., Baklanov A., Belan B., Khodzher T. V., Obolkin V.

A., Staroverova A., Vlasov A., Zagaynov V. A., Lushnikov A., Lyubovtseva Y. S., Riipinen I., Kerminen V.-M., Kulmala M (2008), Aerosol particle formation events at two Siberian stations inside the boreal forest, *Boreal Environment Research.* v.13, N2, p. 81–92

Eremenko S. and Ankilov A., Conversion of the diffusion battery data to particle size distribution: Multiple Solutions Averaging algorithm (MSA), *Journal of Aerosol Science* 26, Suppl 1, 749-750.

Koutsenogii*P.*,Jaenicke R. (1994), Number concentration and size distribution of atmospheric aerosol in Siberia, *J. Aeros. Sci*., 25, 377-383.

Koutsenogii P.K. (1997). Aerosol measurements in Siberia. *Atmos. Res. 44: 167–173.*

Kulmala, M., K. Hämeri, P.P. Aalto, J.M. Makela, L. Pirjola, E.D. Nilsson, G. Buzorius, U. Rannik, M. Dal Maso, W. Seidl, T. Hoffmann, R. Janson, H-C. Hansson, Y. Viisanen, and A. Laaksonen, C.D. O'Dowd, (2001), Overview of the international project on biogenic aerosol formation in the boreal forest (BIOFOR). *Tellus B*, 53: 324–343.

Mäkela. , J. M., Aalto, P., Jokinen, V., Pohja, T., Nissinen, A., Palmroth, S., Markkannen, T., Seitsonen, K., Lihavainen,H. and Kulmala,M (1997), Observations of ultrafine aerosol particle formation and growth in boreal forest, *Geophys. Res. Lett.* 24. P.1219–1222