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Measurements of Ultra-fine and Fine Aerosol Particles over Siberia: Large-scale Airborne Campaigns

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In this paper we discuss the results of *in-situ* measurements of ultra-fine and fine aerosol particles carried out in the troposphere from 500 to 7000 m in the framework of several International and Russian State Projects. Number concentrations of ultra-fine and fine aerosol particles measured during intensive airborne campaigns are presented. Measurements carried over a great part of Siberia were focused on particles with diameters from 3 to 21 nm to study new particle formation in the free/upper troposphere over middle and high latitudes of Asia, which is the most unexplored region of the Northern Hemisphere. Joint International airborne surveys were performed along the following routes: Novosibirsk-Salekhard-Khatanga-Chokurdakh-Pevek-Yakutsk-Mirny-Novosibirsk (YAK-AEROSIB/PLARCAT2008 Project) and Novosibirsk-Mirny-Yakutsk-Lensk-Bratsk-Novosibirsk (YAK-AEROSIB Project). The flights over Lake Baikal was conducted under Russian State contract.

Concentrations of ultra-fine and fine particles were measured with automated diffusion battery (ADB, designed by ICKC SB RAS, Novosibirsk, Russia) modified for airborne applications. The airborne ADB coupled with CPC has an additional aspiration unit to compensate ambient pressure and changing flow rate. It enabled to classify nanoparticles in three size ranges: 3-6 nm, 6-21 nm, and 21-200 nm.

To identify new particle formation events we used similar specific criteria as Young et al. (2007): (1) $N_{3-6nm} > 10$ cm^{-3}, (2) R_1=N_{3-6}/N_{621} >1 and R_2=N_{321}/N_{21200} >0.5. So when one of the ratios R_1 or R_2 tends to decrease to the above limits the new particle formation is weakened. It is very important to notice that space scale where new particle formation was observed is rather large. All the events revealed in the FT occurred under clean air conditions (low CO mixing ratios).

Measurements carried out in the atmospheric boundary layer over Baikal Lake did not reveal any event of new particle formation. Concentrations of ultra-fine particles were even lower than ones observed in the polar FT.

Summarising the data obtained during two intensive measurement campaigns carried out over the vast territory of Siberia we can draw the conclusion that remote Siberian troposphere is a relatively efficient source of recently formed particles. Measurements carried out in the FT (3-7 km) showed that about 44% of them satisfied criteria of new particle formation. At the same time, more favourable conditions are observed between 5 and 7 km (48%).

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