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Understanding the sources and formation mechanisms of nucleation mode particles by measuring 1 nm particles

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Atmospheric new particle formation (NPF) has been observed almost all over the world; in pristine locations such as Antarctic and boreal forest zone in northern hemisphere, but also in highly polluted mega cities such as Shanghai (Kulmala et al. 2013, Xiao et al. 2015, Kontkanen et al. 2017). The same studies have further shown that the processes forming the Nano Cluster Aerosol (NCA), with diameters close to 1 nm, are often different from the processes that grow the clusters into 2 nm particles and larger. NCA can also be emitted directly from vehicle engines (Rönkkö et al. 2017). Atmospheric NCA's can be charged or neutral (Wagner et al. 2017). To determine the sources and growth rates of nucleation mode aerosol particles, the number concentration and size information is needed starting from the critical sizes of 1-2 nm in diameter (Sipilä et al. 2010). The main challenges in measuring the sub 3 nm size distribution are high diffusional losses, unknown charging mechanisms and also effects of chemical composition both to detection and charging of particles. Nano Condensation Nucleus counter (nCNC), instrument based on condensational growth principle, is already widely used to measure particles starting from 1.3 nm in size (Kontkanen et al. 2017). In this presentation, the main challenges and key points of measuring sub 3 nm particle number size distribution are discussed; starting from the calibration of instruments to the sampling procedures.

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