

20 months of particle size distribution measurements at Mt. Tai, central eastern China

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Accumulation of atmospheric pollutants over large areas of Eastern China have been studied with in-situ observations (eg: Shen *et al* 2011) and based on emission inventories (eg: Lu *et al* 2010). In this work (Shen *et al* 2015) we have measured particle number-size-distribution in the size range of 3 nm-2.5 μm over a 20-month period at a mountaintop site at Mt. Tai (36.25°N, 117.10°E, 1534 m asl.) in the middle of this heavily polluted region of China.

Mt. Tai is the highest mountain in the region, resulting in a clear diurnal pattern of planetary boundary layer (PBL) and free troposphere (FT) air. We separated the times when the site was within PBL and FT based on mean diurnal patterns of specific humidity and normalized number concentration of Aitken (N_{Ait}) and accumulation (N_{acc}) mode particles. This was done for each season separately.

The mean particle number concentration observed at Mt. Tai was 13000 cm^{-3} in PBL and 4800 cm^{-3} in FT conditions. These numbers are very high compared to other high altitude sites. The high particle number concentrations are due to two factors: accumulation of particles on regional scale and frequent intense new particle formation (NPF) events. Both can be linked to high anthropogenic emissions of primary particles and condensable gases.

Particle number concentration in all modes showed both seasonal and diurnal cycles. Highest seasonal particle number concentrations were observed during spring due to most frequent NPF and during summer due to slow moving air masses in PBL favouring accumulation of particles. Lowest particle number concentrations were observed during winter. The diurnal patterns (Figure 1) were governed by both PBL / FT cycle and by NPF events. It is worth noting that N_{acc} was higher during non-NPF days than during NPF days. It can be speculated that the high condensation sink prevents new particle formation.

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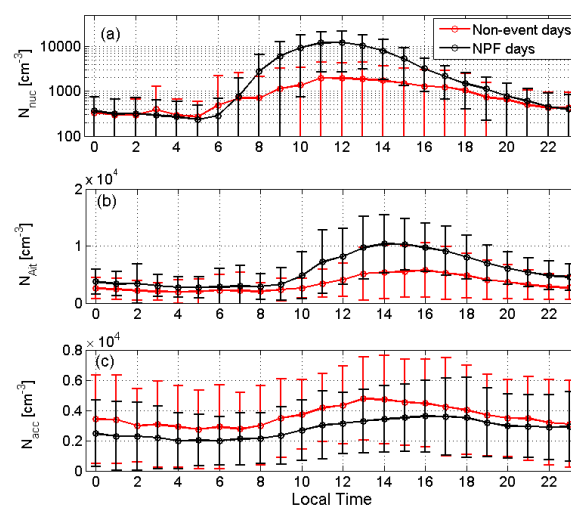


Figure 1. Diurnal variation of nucleation-, Aitken- and accumulation mode particle number concentration during days without and with new particle formation events. Note the logarithmic scale in panel a.

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