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Fluggestütze Beobachtung von Partikelneubildung in der Grenzschicht

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We studied the influence of atmospheric boundary-layer (ABL) development on new particle formation (NPF) during the morning transition. Continuous in-situ measurements of vertical profiles of the ABL were measured near Melpitz, Germany by unmanned aerial systems to understand the potential connection between NPF and boundary-layer development in the context of turbulence, temperature and humidity fluctuations. On April 3, 2014 high number concentrations of nucleation mode particles up to 6.0x10^4 cm^-3 in the diameter range 5-10 nm) were observed in an inversion layer located about 450 m above ground level. Importantly, the inversion layer exhibited a spatial temperature structure parameter CT2 10 times higher and a spatial humidity structure parameter CQ2 5 times higher than in the remaining part of the vertical profile. We assume that the inversion layer is responsible for creating favorable thermodynamic conditions for a NPF event. In addition, this layer showed a strong anti-correlation of humidity and temperature fluctuations. Using estimates of the turbulent mixing and dissipation rates, we conclude that the downward transport of particles by convective eddies was also the cause of the sudden increase of nucleation mode particles in the surface observations. This work supports the hypothesis that many of the NPF events that are frequently observed near the ground may, in fact, originate at elevated altitude, with newly formed particles subsequently being mixed down to the ground.