Ultrafine particle number flux over and in a deciduous forest

Ultrafine particles (UFP, particles with diameters (Dp) < 100 nm) play a key role in climate forcing; thus, there is interest in improved understanding of atmosphere-surface exchange of these particles. Long-term flux measurements from a deciduous forest in the Midwestern USA (taken during December 2012 to May 2014) show that although a substantial fraction of the data period indicates upward fluxes of UFP, on average, the forest is a net sink for UFP during both leaf-active and leaf-off periods. The overall mean above-canopy UFP number flux computed from this large data set is $-4.90 \times 10^6 \text{m}^{-2} \text{s}^{-1}$ which re-emphasizes the importance of these ecosystems to UFP removal from the atmosphere. Although there remain major challenges to accurate estimation of the UFP number flux and in drawing inferences regarding the actual surface exchange from measurements taken above the canopy, the above the canopy mean flux is shown to be downward throughout the day (except at 23.00) with largest-magnitude fluxes during the middle of the day. On average, nearly three quarters of the total UFP capture by this ecosystem occurs at the canopy. This fraction increases to 78% during the leaf-active period, but the over-storey remains dominant over the subcanopy even during the leaf-off period.

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