

Performance and Comparison Measurements of a New Ultrafine Particle Monitor for Ambient Air

Motivation

Ultrafine particle (UFP) monitoring is relevant in terms of human health since nano particles can have serious impacts on our health due to their ability to penetrate deep into the lung and body. Common standard reference instrumentation for continuous ambient air monitoring like CPC (Condensation Particle Counter) and SMPS (Scanning Mobility Particle Sizer) are cost and maintenance intensive.

To generate comparable results for ambient monitoring without the disadvantages mentioned above, a unipolar diffusion charger (Figure 1), combining an ejector-based sampling method and air-jet charging, is used.

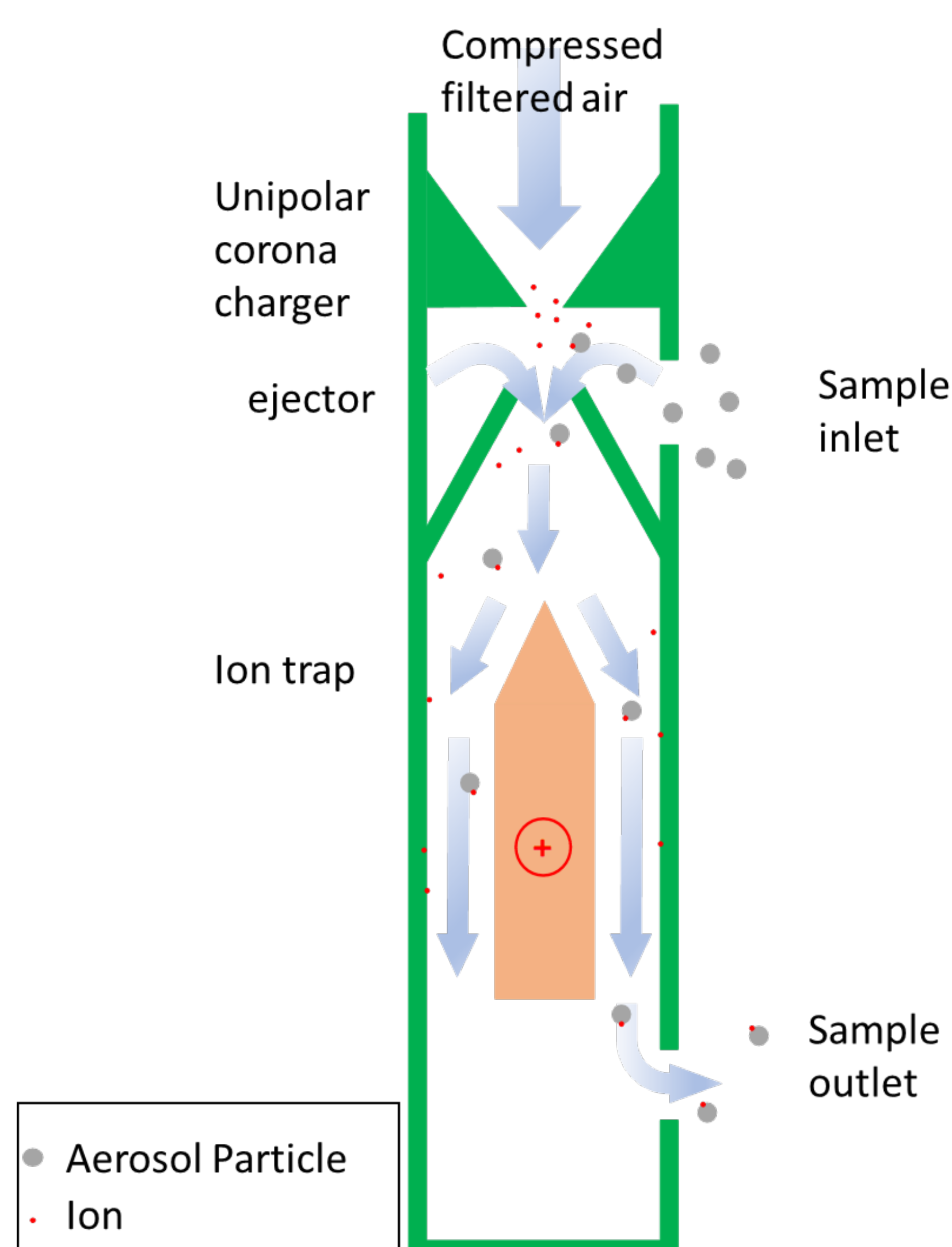


Figure 1: Functional principle of the unipolar diffusion charger

Experimental setup

Various measurements with definite laboratory and environmental aerosols (Figure 2) were conducted, including long term measurements at different ambient conditions. The lower particle size detection limit of the CPCs and the unipolar diffusion charger was adjusted to 10 nm.



Figure 2: Outdoor measuring station at an intersection

Lab measurements

A lab-generated polydisperse NaCl aerosol was measured to compare the behaviour of a CPC and the AQ Guard smart 2000 (unipolar diffusion charger) for different particle number concentrations. Figure 3 shows the good comparability between both monitoring systems.

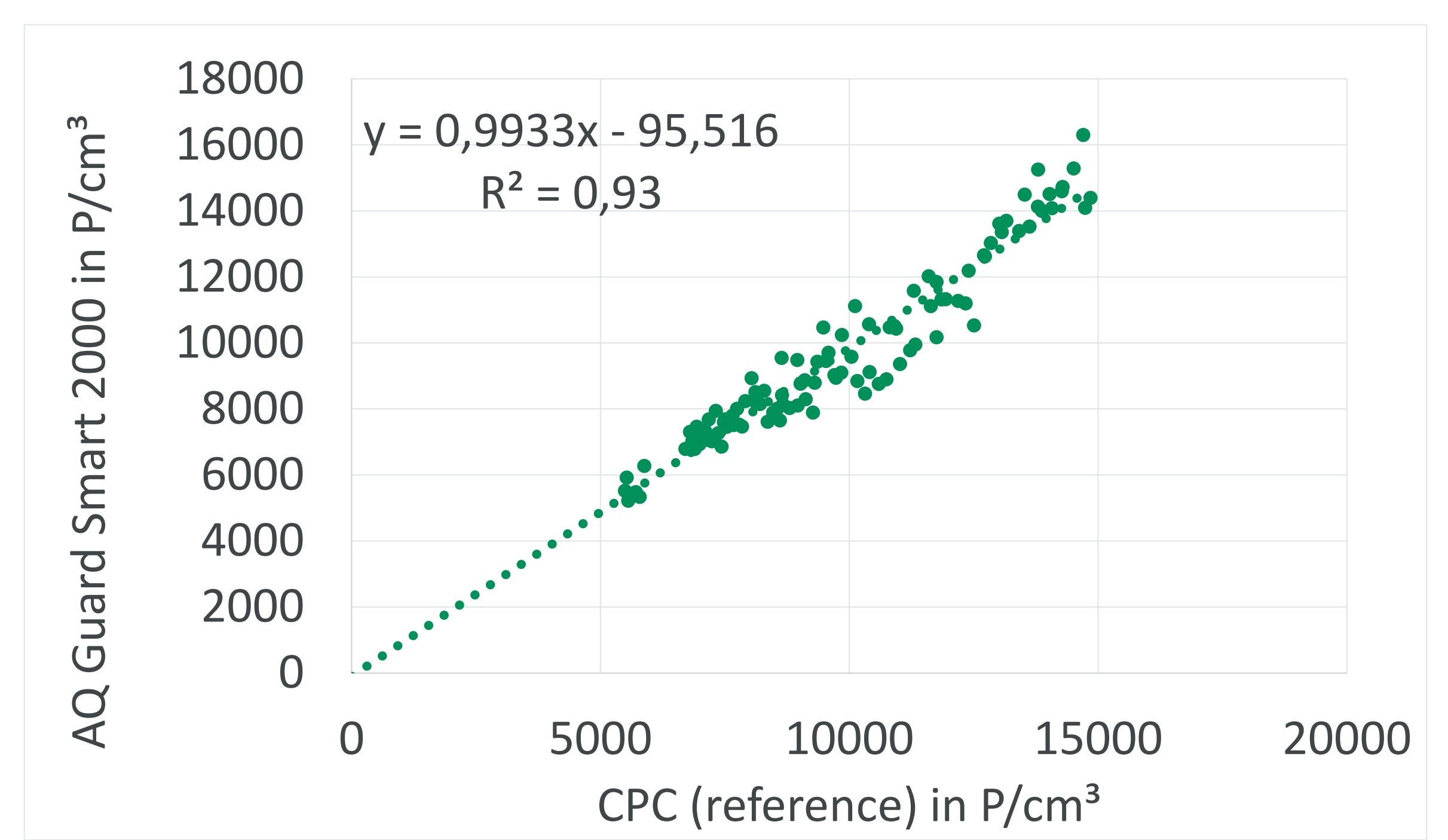


Figure 3: Correlation of AQ Guard Smart 2000 vs CPC with a NaCl aerosol

Ambient air measurements

Further validation of the unipolar diffusion charger system were long term measurements at an intersection near to the Palas® headquarter. (Figure 4)

- Sunday 15th to Monday 16th after 2:30 p.m. :
Mean diameter > 80 nm, typical outdoor air, low concentrations
- Monday 16th after 2:00 p.m. :
Mean diameter < 80 nm, typical for anthropogenic and combustion sources, continuous increase in UFP concentrations
- Monday 16th approx. 7:30 a.m. :
Mean diameter minimum and concentration maximum.
Increased traffic from UPS leaving the distribution center, traffic jam at junction near to measurement device

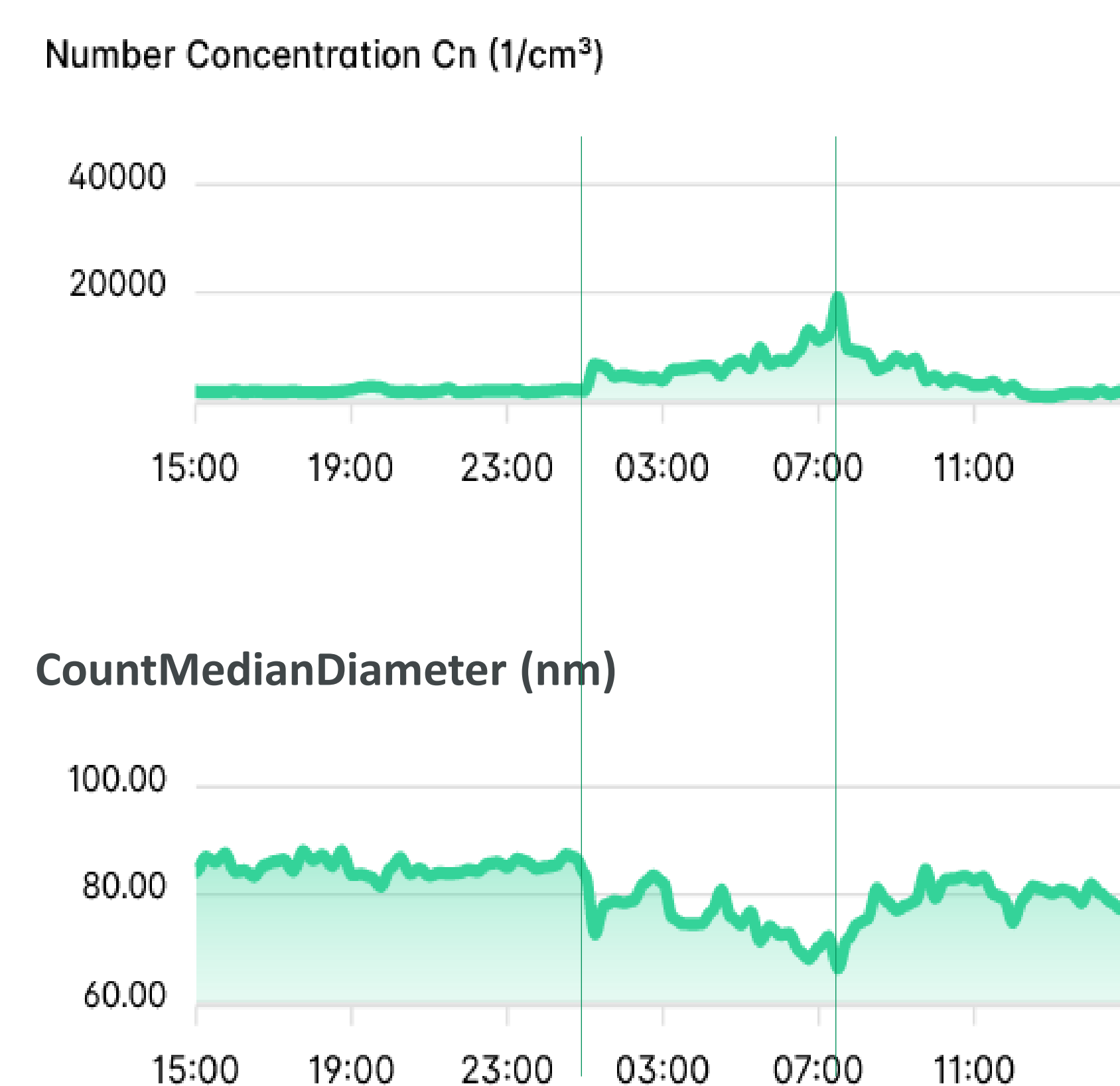


Figure 4: Data directly taken from Palas® Cloud MY Atmosphere

