Supplement of Atmos. Chem. Phys., 23, 183–201, 2023
https://doi.org/10.5194/acp-23-183-2023-supplement

Atmospheric Chemistry and Physics
Open Access

Supplement of

Measurement report: Atmospheric new particle formation at a peri-urban site in Lille, northern France

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New Particle Formation (NPF) size distribution

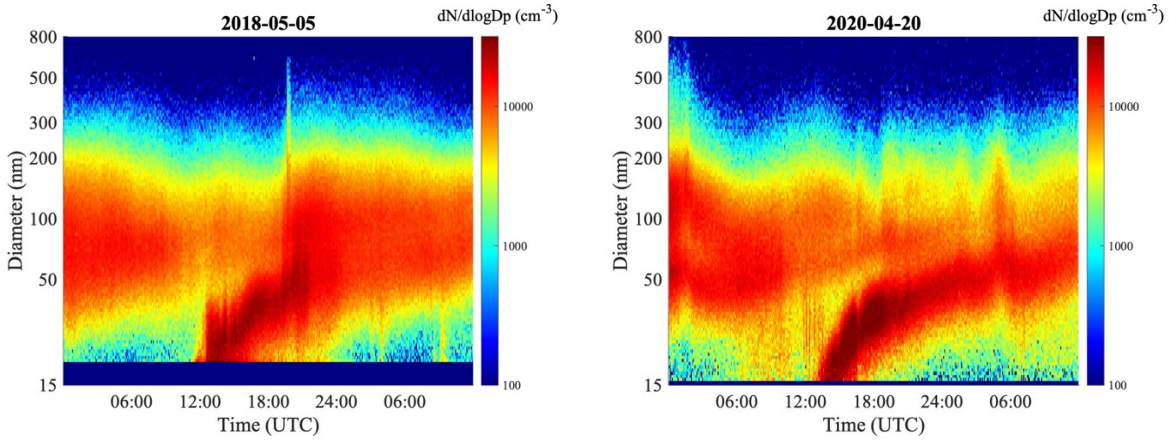

Figure S1: Examples of banana plots depicting particle number size distribution (15.7 nm < Dp < 800 nm) observed during spring (a) on 5th May 2018 and (b) 20th April 2020.

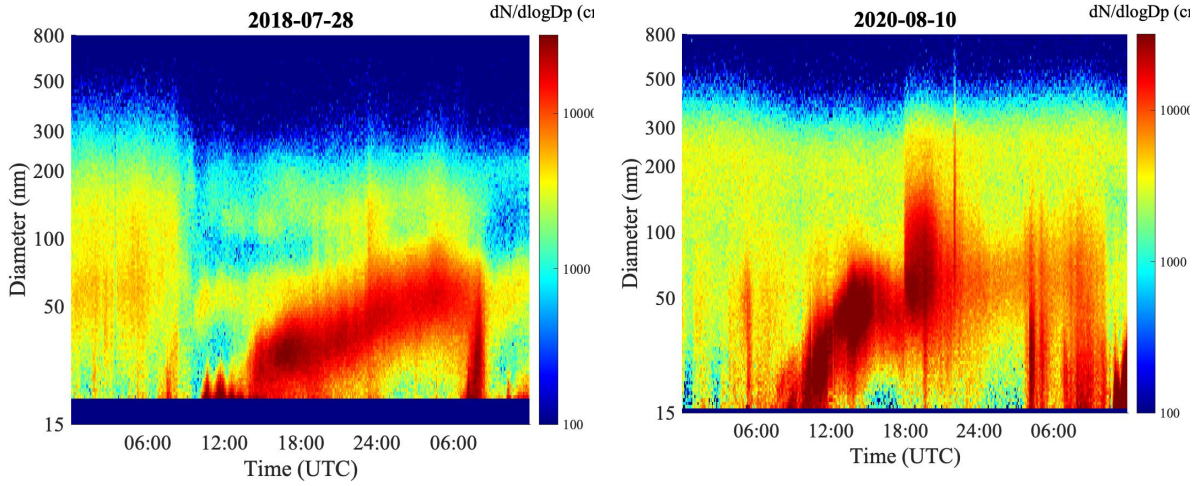

Figure S2: Examples of banana plots depicting particle number size distribution (15.7 nm < Dp < 800 nm) observed during summer (a) on 28th July 2018 and (b) 10th August 2020.

Link to Cloud Condensation Nuclei (CCN)

Atmospheric NPF events are known to be an important source of CCN (Pierce and Adams, 2009). To estimate their potential impact, we plotted the diel profiles of $NSF_{50\text{-}100}$ for both seasons (MAM and JJA) (Figure S3b). The $NSF_{50\text{-}100}$ values are ranging from 1 to 1.6. The maximum values are reached during the afternoon at 16:00 and 15:00 UTC during spring and summer, respectively. Of course, the values are not as important as $NSF_{15.7\text{-}100}$ but it still highlights the large impact of NPF events over ATOLL. Indeed, the concentration of CCN-like particles ($50 < D_p < 100$ nm) shows an increase during the early afternoon up to a factor of 0.7 (0.3) during summer (spring, Figure S3a) during event days in comparison to non event days. This phenomenon may have a large influence on the CCN concentration available for activation but this point needs to be further studied with a CCN counter to evaluate particle hygroscopicity.

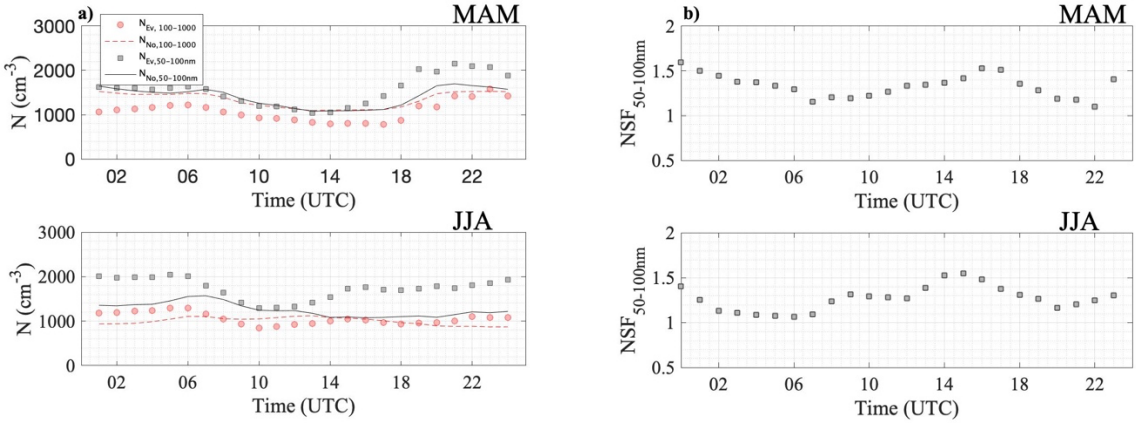

Figure S3 : (a) Diel variations of number concentrations of particles with diameter from 50 to 100 nm (N50−100 in black) and from 100 to 1000 nm (N100−1000 in red) during MAM and JJA at the ATOLL site during the 2017-2020 period. The dots correspond to NPF event days while the line correspond to non-event days. (b) Diel variations of the Nucleation Strength Factor (NSF50-100) for each season calculated from N50-100 and N100−800 observed during the 2017-2020 period.

Pierce, J.R., Adams, P.J., 2009. Uncertainty in global CCN concentrations from uncertain aerosol nucleation and primary emission rates. Atmospheric Chemistry and Physics 9, 1339–1356. https://doi.org/10.5194/acp-9-1339-2009