Supplement of Atmos. Chem. Phys., 22, 11759–11779, 2022
https://doi.org/10.5194/acp-22-11759-2022-supplement

Supplement of

Experimental development of a lake spray source function and its model implementation for Great Lakes surface emissions

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Figure S1 Sampling location in Claytor Lake.

Table S1 Claytor Lake water samples metadata: collection date and time, water salinity, and water temperature at collection.

Water sample	**Collection date and time**	**Water salinity at collection* (ppt)**	**Water temperature at collection* (ºC)**
Claytor Lake (October)	31 October 2020, 10:00-10:30 LT	0.05	14.4
Claytor Lake (August)	9 August 2021, 10:00-10:30 LT	0.05	26.8

* As measured by an Extech EC170 salinity-temperature meter.

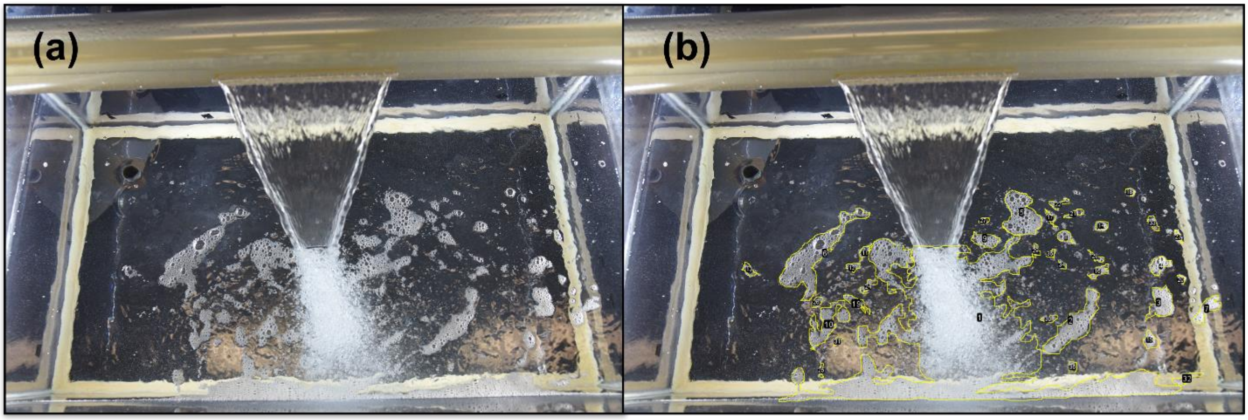

Figure S2 (a) Surface foam generated by the MART using synthetic saltwater and **(b)** the corresponding outlined area produced manually using the ImageJ software.

Table S2 Summary of the water and air properties in each experiment conducted in the MART.

Water sample	Water temperature at the start/end of the experiment* (ºC)	Water salinity at the start/end of the experiment* (ppt)	Air temperature** (ºC)	Air RH** (%)
Synthetic freshwater (with dryer)	21.5/27.1	0.09/0.10	22.3	33
Synthetic freshwater (without dryer)	22.4/29.4	0.08/0.08	23.9	94
Synthetic saltwater (with dryer)	23.1/31.2	27.7/27.9	23.5	36
Synthetic saltwater (without dryer)	21.4/28.0	28.3/27.5	24.1	94
Claytor Lake (October)	19.5/27.7	0.09/0.10	23.3	90
Claytor Lake (August)	26.0/30.1	0.05/0.05	24.1	91

* As measured by an Extech EC170 salinity-temperature meter.

** As measured by a HOBO UX100-011 temperature-RH data logger.

S1 Wall loss coefficient (k) determination

To determine the wall loss coefficient k inside the MART, we arrest water flow ($E = 0$) and measure the decay of aerosol number concentration (Quadros and Marr, 2011; Lin and Marr, 2017). During this decay phase, the mass balance (Eq. (6)) reads:

$$\frac{dC_{out}}{dt} = -a\, C_{out} \tag{S1}$$

In Eq. (S1), the coefficient a is:

$$a = k + \frac{Q_{in}}{V} \tag{S2}$$

Hence, Eq. (S2) can be rearranged to obtain the wall loss coefficient k as follows:

$$k = a - \frac{Q_{in}}{V} \tag{S3}$$

The coefficient a in Eq. (S3) was determined by plotting the natural logarithm of the number concentration inside the MART ($\ln C_{out}$) versus time (t) during the decay phase for submicron (Fig. S3a) and supermicron particles (Fig. S3b). In these plots, a is the slope of the linear fit to the data.

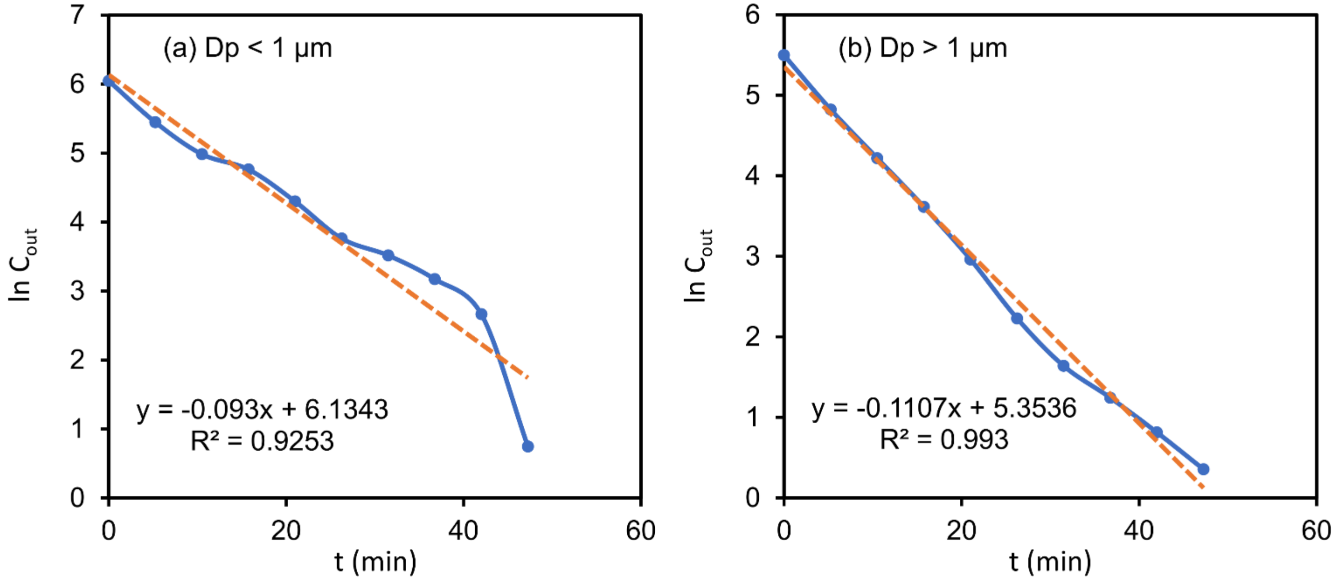

Figure S3 The decay of ln C_{out} versus time t in the synthetic saltwater experiment (wet) for **(a)** submicron and **(b)** supermicron aerosols inside the MART. Also shown are the linear fits to the data for each particle size range.

S2 Estimate of particle losses in the TSI 3062 diffusion dryer

We follow the procedure proposed by Von Der Weiden et al. (2009) to estimate tubing losses in a simplified model of the TSI 3062 diffusion dryer consisting of a straight dryer tube with a length *L* equal to 53.5 cm and an inner diameter *d* equal to 12.7 mm, and two 90º-elbows on each side each having an inner diameter *d* equal to 12.7 mm and a length *L* equal to 6 cm (Fig. S4a). The air flow rate in the dryer Q is set to 1.3 $Lmin^{-1}$, which is the combined sampling flow rate of the SMPS and APS. The estimated particle losses versus particle diameter are shown in Fig. S4b. Particles were assumed to have a density of 1500 kgm^{-3} and to be spherical with a shape factor equal to 1.

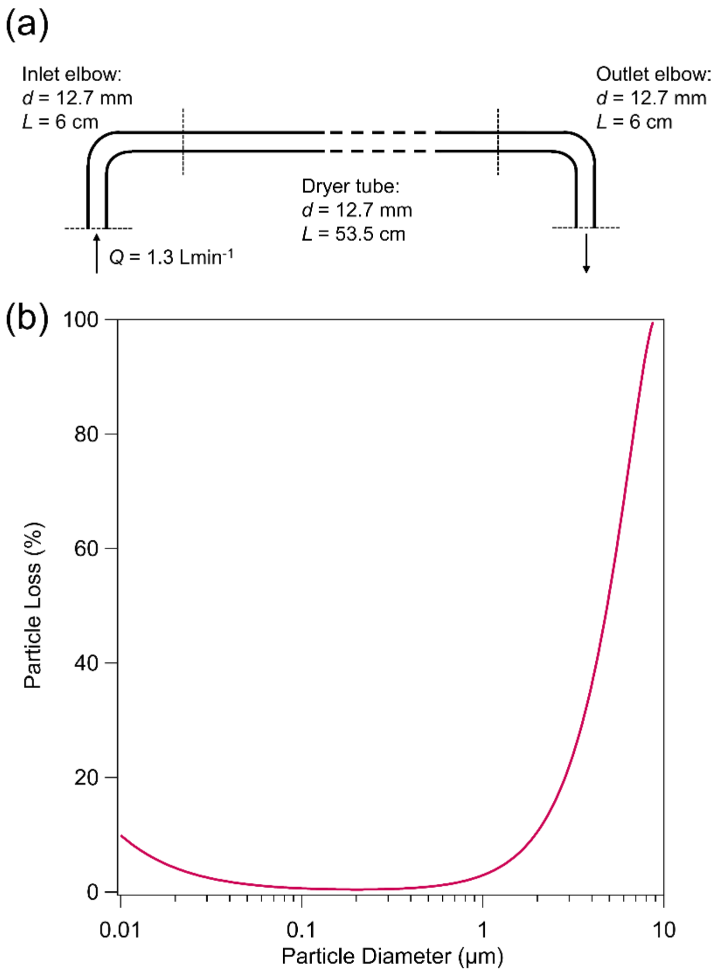

Figure S4 (a) A simplified tubing configuration of the TSI 3062 diffusion dryer and **(b)** the corresponding particle loss in the dryer calculated using the procedure in Von Der Weiden et al. (2009).

References

Lin, K. and Marr, L. C.: Aerosolization of Ebola virus surrogates in wastewater systems, Environmental science & technology, 51, 2669-2675, 2017.

Quadros, M. E. and Marr, L. C.: Silver nanoparticles and total aerosols emitted by nanotechnology-related consumer spray products, Environmental science & technology, 45, 10713-10719, 2011.

von der Weiden, S. L., Drewnick, F., and Borrmann, S.: Particle Loss Calculator – a new software tool for the assessment of the performance of aerosol inlet systems, Atmos. Meas. Tech., 2, 479-494, 10.5194/amt-2-479-2009, 2009.