

*Supplement of*

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

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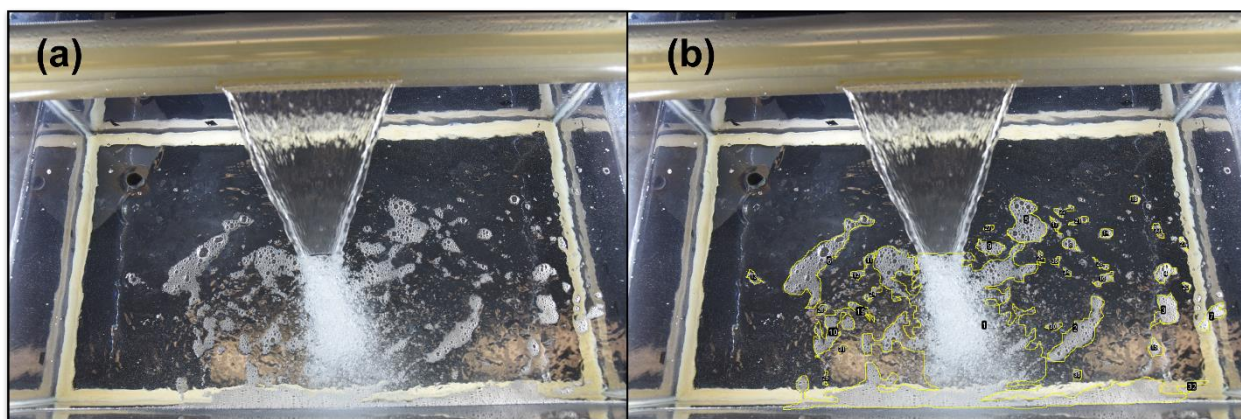


**Figure S1** Sampling location in Claytor Lake.

**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* (°C)
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* (°C)	Water salinity at the start/end of the experiment* (ppt)	Air temperature** (°C)	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:

$$\frac{dC_{out}}{dt} = -a C_{out} \quad (S1)$$

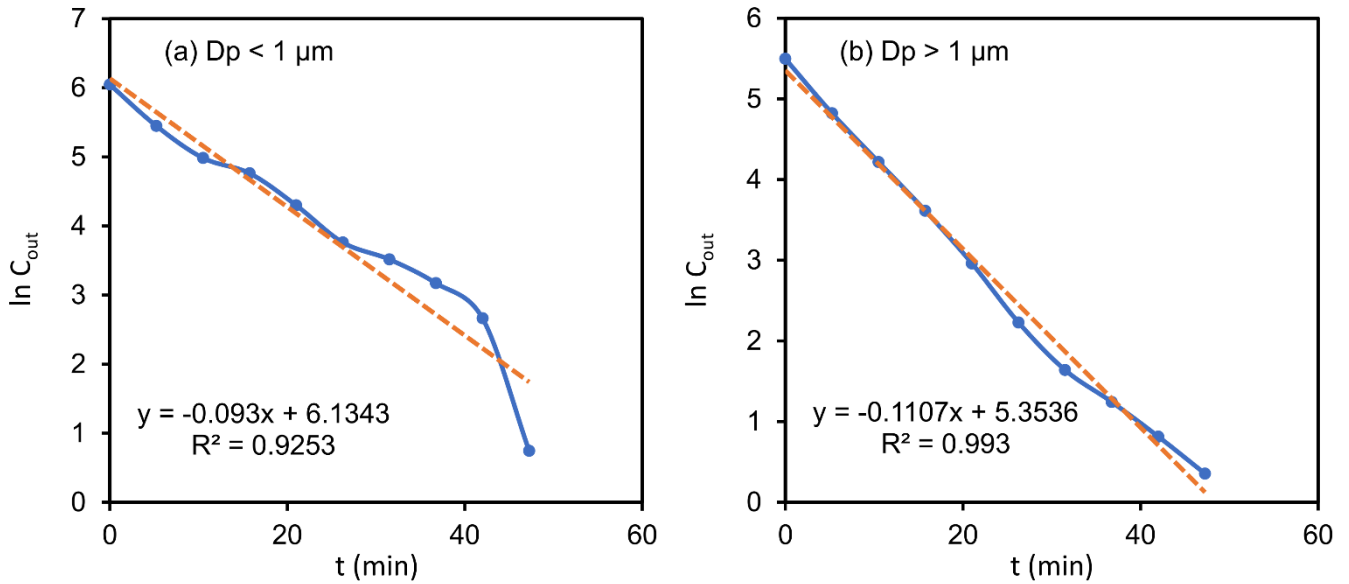
In Eq. (S1), the coefficient  $a$  is:

$$a = k + \frac{Q_{in}}{V} \quad (S2)$$

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

$$k = a - \frac{Q_{in}}{V} \quad (S3)$$

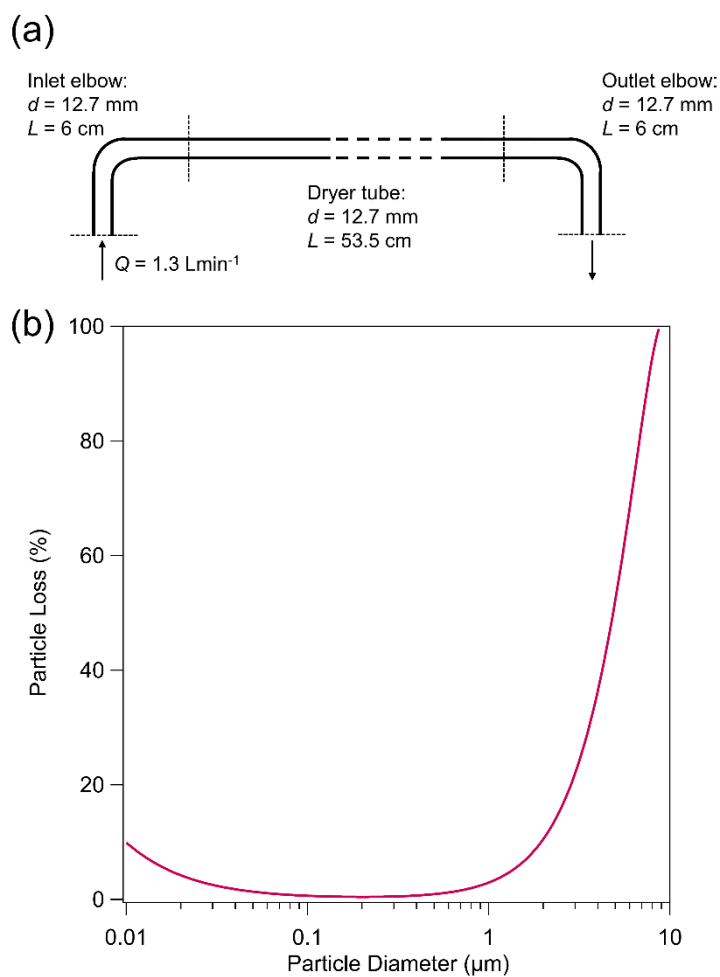
The coefficient  $a$  in Eq. (S3) was determined by plotting the natural logarithm of the number concentration inside the MART ( $\ln C_{out}$ ) versus time ( $t$ ) during the decay phase for submicron (Fig. S3a) and supermicron particles (Fig. S3b). In these plots,  $a$  is the slope of the linear fit 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 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 90°-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  $1.3 \text{ Lmin}^{-1}$ , 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  $1500 \text{ kgm}^{-3}$  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.