

## Supplementary Materials:

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### Determination of the rotation angle of TRAPS impaction plates

The choice of the rotation angle value in steps of  $28.8^\circ$  is the result of a compromise between the minimum rotation angle, to avoid overlapping between two impaction traces, and technical/mechanical constraints. The device uses two stepper motors (200 steps for  $360^\circ$ , i.e.  $1.8^\circ$  per step). Although the electronic control allows us to drive the motor steps very precisely ( $\pm 0.11^\circ$  per step); this method requires maintenance of a current in the motor coil to keep its axe in position. This produces a heating of the motor blocks and then of the impactor, which can result in a loss of the most volatile particles. To avoid this, we chose to switch off the current after each rotation. When the current is off, the motor axe moves back to a reference position related to its built-in design. This position is found every 4 steps, i.e.,  $1.8^\circ \times 4 = 7.2^\circ$ . A factor  $< 4$  is insufficient to avoid overlapping between two traces. We therefore chose a rotation angle of  $7.2^\circ \times 4 = 28.8^\circ$ .

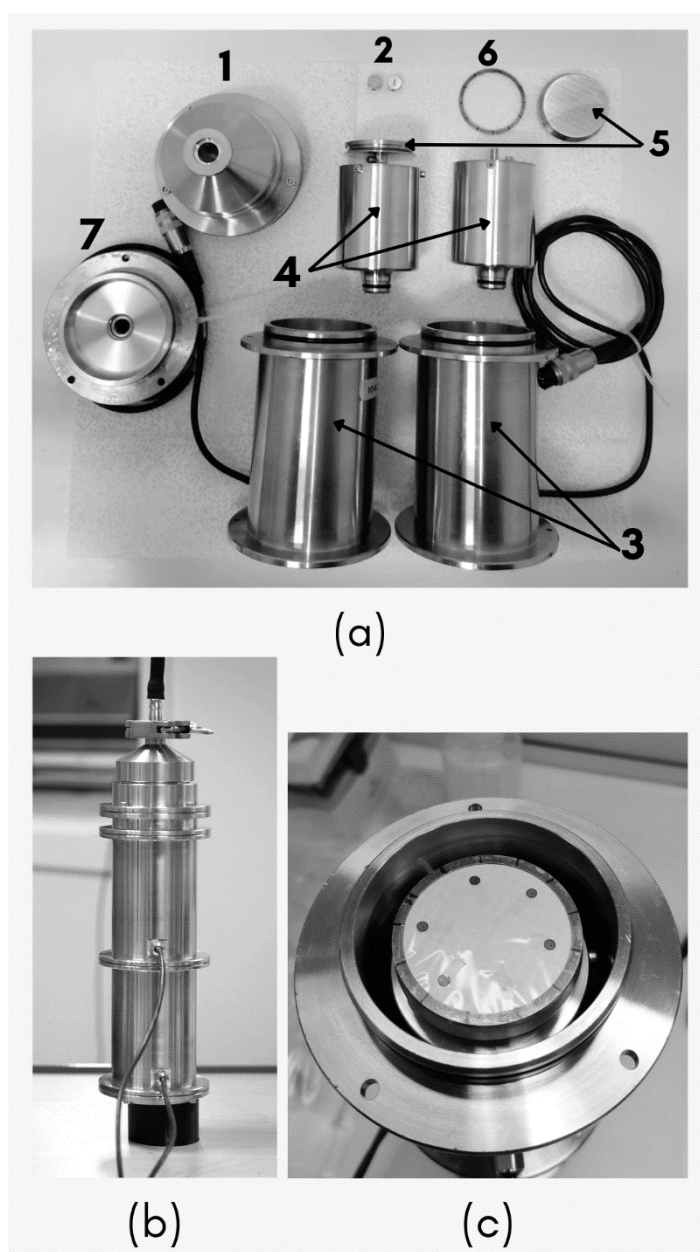
**Table S1.** Technical characteristics of the TRAPS.

Name	TRAPS for Time Resolved Atmospheric Particle Sampler
Weight	6.75 kg
Dimensions (d × h)	10.2 × 35 cm
Sample flow	5 L/min
Sampling range	Fine (PM <sub>0.1-1</sub> ) and Coarse mode particles (PM <sub>1-10</sub> )
Sampling duration	Adjustable (minute, hour, day)
Rotation angle	$28.8^\circ$ (enables the collection of maximum 12 samples/plate)
Sampling substrate	Whatman Nuclepore™ (or equivalent) track-etched polycarbonate membranes (47 mm diameter and 0.015 µm pore size) or TEM grids
Pump type	KNF Laboport N816.18
Parts of the device (see Figure S1.)	<ul style="list-style-type: none"> <li>• Preimpaction head (Air inlet) (1)</li> <li>• 2 rectangular nozzles: PM<sub>1-10</sub> and PM<sub>0.1-1</sub> (2)</li> <li>• 2 cylindrical blocks (3) (supporting the motors) (4)</li> <li>• 2 collection plates with their 50 mm diameter clips (5)</li> <li>• Cover (air outlet) (6)</li> </ul>

**Table S2.** Chemical characteristics and possible sources of different types of individual particles.

Particle Type	Elemental composition	Main compounds	Possible source
Carbonaceous	C, O, with minor amounts of N, Si, S	Soot, organics	Incomplete combustion of biomass or fossil fuel from anthropogenic activities, emissions of volatile and semi-volatile organic compounds
S-rich	S, N, K, O, with minor amounts of	Ammonium sulfate,	Secondary aerosols formation, Biomass burning for K-rich

	C, Si, Al, Na, Ca, Fe	ammonium nitrate, potassium sulfate	
Na-rich	Na, Cl, N, O, with minor amounts of Mg, S, Ca,	Sodium chloride, sodium nitrates and sulfates, mixed sodium species	Fresh sea salts, aged marine sea-salts when incorporating N and/or S
Ca-rich	Ca, C, N, S, O, with minor amounts of Na, Si, Al, K, Fe	Calcite, gypsum, mixed Ca salts with aluminosilicates or sea salts	Re-suspended soils, road dust or industrial burning emissions
Si-Al-rich	Si, Al, , with minor amounts of Ca, Fe, K, Mg	Aluminosilicates, silica, mixed silicates (with Ca salts or Fe oxides)	Resuspended sand or road dust, industrial ashes
Metals	Fe, Mn, Zn, O, with minor amounts of Ti, Si, Al, Ca, K, S, N	Mainly iron, mn and zinc oxydes	Metallurgy, steelworks, coal fire plants, chemical plants and/or oil refineries
Unclassified particles		Mix of different elements in irrespective proportions	



**Figure S1.** Photographs of (a) TRAPS parts, (b) the fully assembled TRAPS, and (c) a collection plate with five TEM grids mounted on a polycarbonate membrane.

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LOG - Notepad
File Edit Format View Help
1. 2021-04-19 14:43:26 : ligne 1 : cette ligne est un commentaire.
impact 1 : debut le 2021-04-19 18:00:05
2. fin le 2021-04-19 19:00:07
duree : 01:00:02
disque 1 : 1/12 - disque 2 : 1/12

3. impact 2 : debut le 2021-04-19 19:01:00
fin le 2021-04-19 20:01:02
4. duree : 01:00:02
disque 1 : 2/12 - disque 2 : 2/12

impact 3 : debut le 2021-04-19 20:02:01
fin le 2021-04-19 21:02:02
duree : 01:00:01
5. disque 1 : 3/12 6. disque 2 : 3/12 7.
impact 4 : debut le 2021-04-19 21:03:00
fin le 2021-04-19 22:03:02
duree : 01:00:02
disque 1 : 4/12 - disque 2 : 4/12
PM_0.1 stage
PM_1 stage

impact 5 : debut le 2021-04-19 22:04:00
fin le 2021-04-19 23:04:02
duree : 01:00:02
disque 1 : 5/12 - disque 2 : 5/12

impact 6 : debut le 2021-04-19 23:05:00
fin le 2021-04-20 00:05:02
duree : 01:00:02
disque 1 : 6/12 - disque 2 : 6/12

impact 7 : debut le 2021-04-20 00:06:01
fin le 2021-04-20 01:06:02
duree : 01:00:01
disque 1 : 7/12 - disque 2 : 7/12

impact 8 : debut le 2021-04-20 01:07:00
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duree : 01:00:02
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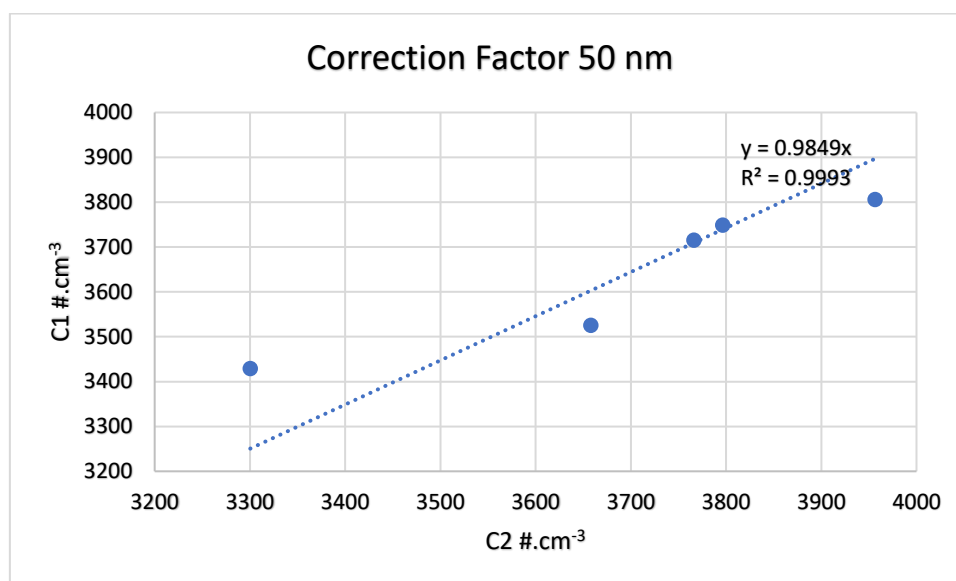
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impact 10 : debut le 2021-04-20 03:09:00
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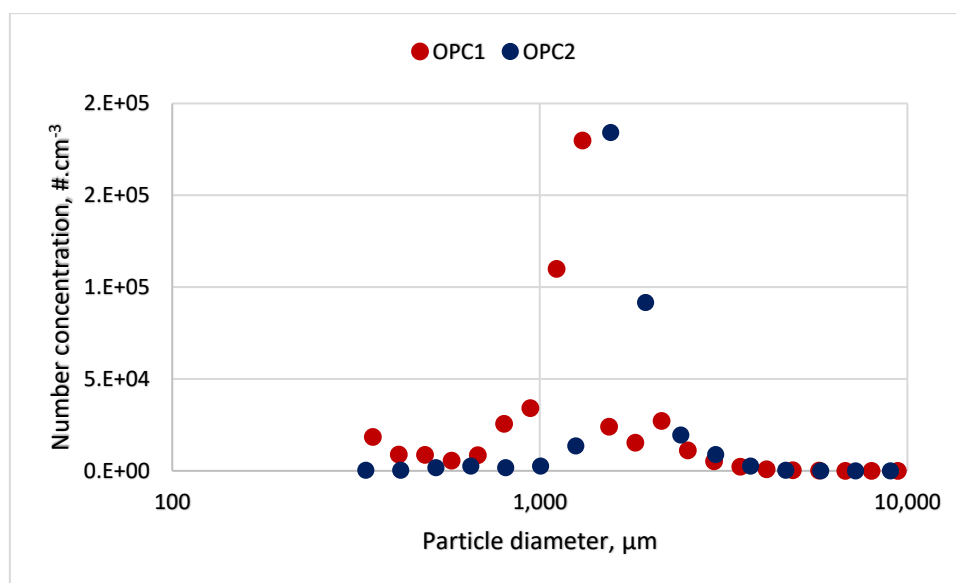
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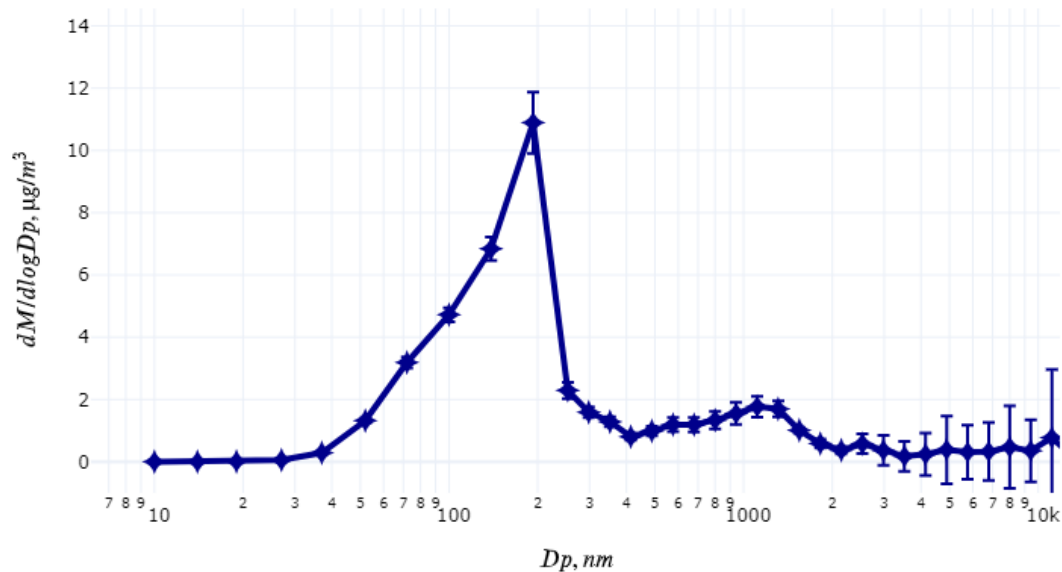
**Figure S2.** Output file extracted at the end of each TRAPS sampling series. Main information in the colored frames include: 1. date and time of the introduction of the SD card in the command board; 2. sample's (impact) start and end date and time; 3. sample number; 4. sampling duration; 5. rotation of the PM1 stage; 6. rotation of the PM0.1 stage; 7. example of the 3rd out of 12 possible samples.



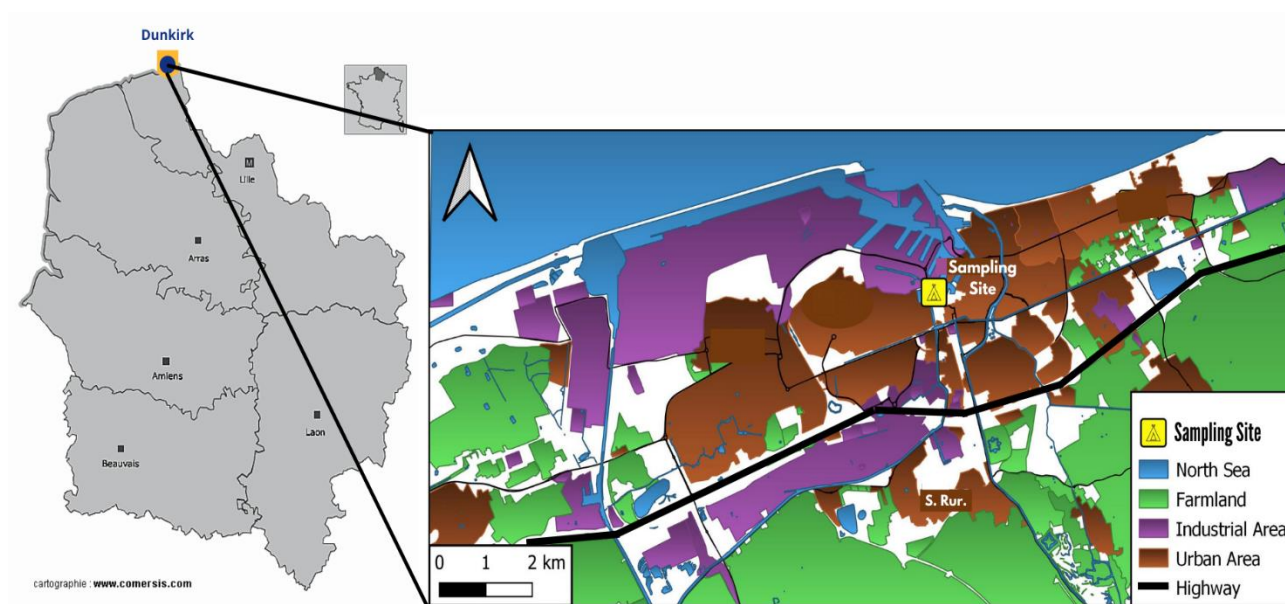
**Figure S3.** Determination of the correction factor between CPC1 and CPC2. A Linear regression was drawn from the different levels of particle number concentrations measured with collocated CPC1 and CPC2.



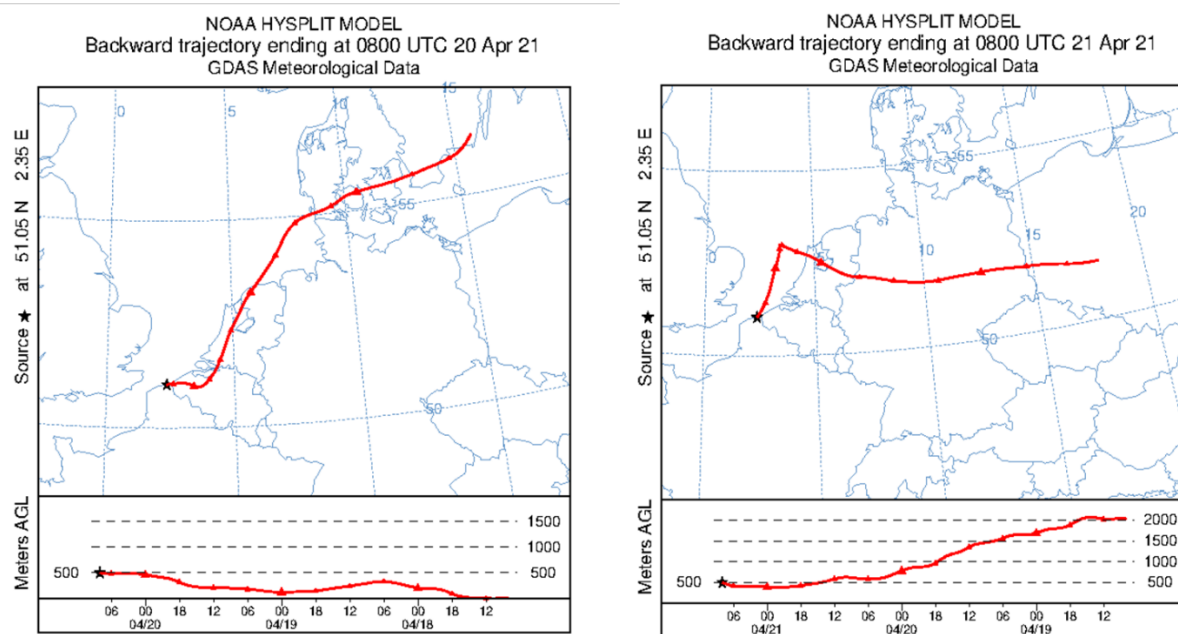
**Figure S4.** Comparison between OPC MiniWRAS Grimm and OPS TSI for particle size distribution. The observed shift is related to the differences in the measurement channels of the two instruments.



**Figure S5.** Mean particle mass size distribution obtained using an optical particle counter (MiniWRAS model 1371 Grimm™) on June 13<sup>th</sup> 2021 from 08:00 to 10:00 UTC.



**Figure S6.** Study area.



**Figure S7.** 72 hour back-trajectory calculations arriving at 500 m altitude at the sampling site respectively on April 20<sup>th</sup> and April 21<sup>st</sup> at 08:00 UTC.