

Intercomparison of Mobility Particle Size Spectrometers

<i>Project No.:</i>	OSIA-2019-1-2
<i>Principal Investigator:</i>	UBA
<i>Home Institution:</i>	UBA
<i>Participant:</i>	Andreas Schwerin
<i>Candidate:</i>	DE-UBA-Waldhof
<i>Made by:</i>	TROPOS
<i>Counter (SN):</i>	TSI CPC Model 3772-CEN, SN: 3772164503
<i>Software:</i>	TROPOS 6.68
<i>Total CPC:</i>	TSI CPC Model 3772, SN: 70835060
<i>Location of the quality assurance:</i>	Station Waldhof
<i>Comparison period:</i>	December 09, 2019 – December 12, 2019

Summary of Intercomparison

Status:

The candidate passed the quality standards of ACTRIS and GAW during the onsite intercomparison. The system is within the range of +/-10% of the TROPOS Reference MPSS.

The candidate was in a good status. It was not necessary to change or repair parts of the inlet, instrument or counter. The zero, high voltage and PSL checks are in the correct range of tolerance.

Information about the instruments:

Date of check: 09.12.2019

<i>List of Components</i>	TROPOS Reference MPSS No.4	Candidate
<i>Position</i>	-	-
<i>Company</i>	TROPOS	TROPOS
<i>Software</i>	TROPOS	TROPOS
<i>CPC-MPSS</i>	TSI CPC, Model 3772	TSI CPC-CEN, Model 3772
<i>CPC-total</i>	TSI CPC, Model 3772	TSI CPC, Model 3772
<i>flow ratio</i>	1.0 : 5.0	1.0 : 5.0
<i>source</i>	Ni-63	Kr85
<i>HV power supply</i>	positive	Positive
<i>DMA</i>	Hauke medium	Hauke medium
<i>aerosol dryer</i>	✓	✓
<i>aerosol RH- sensor</i>	✓	✓
<i>aerosol T-sensor</i>	✓	✓
<i>sheath RH-sensor</i>	✓	✓
<i>sheath T-sensor</i>	✓	✓
<i>Sheath dryer</i>	✓	✓
<i>pressure sensor</i>	✓	✓

Date of check: 09.12.2019

<i>CPC status</i>	TROPOS-MPSS	TROPOS-total	Candidate-MPSS	Candidate-total
<i>power/status</i>	LED green	LED green	LED green	-
<i>saturation temp</i>	39 °C	39 °C	39 °C	-
<i>condenser temp</i>	22 °C	23.5 °C	22.0 °C	-
<i>optics temp</i>	40 °C	40 °C	40 °C	-
<i>cabinet temp</i>	32.6 °C	31.7 °C	36.6 °C	-
<i>ambient pressure</i>	98.6 kPa	97.2 kPa	97.6 kPa	-
<i>orifice pressure</i>	79.8 kPa	80.3 kPa	82.6 kPa	-
<i>nozzle pressure</i>	2.8 kPa	2.7 kPa	0.4 kPa	-
<i>laser current</i>	59 mA	42 mA	42 mA	-
<i>liquid level</i>	full	full	full	-

Date of check: 09.12.2019

<i>date</i>	TROPOS Reference MPSS		Candidate	
	pre-audit status	final-audit status	pre-audit status	final-audit status
<i>total CPC flow</i>	-	1.062 l/min	-	-
<i>aerosol flow (DMA)</i>	-	-	-	-
<i>aerosol flow (UDMA)</i>	-	-	-	-
<i>aerosol flow (total)</i>	-	1.023 l/min	1.000 l/min	1.000 l/min
<i>zero</i>	-	0 #/cm ³	0 #/cm ³	0 #/cm ³
<i>PSL 203 nm</i>	-	204.54 nm	205.4 nm	205.4 nm
<i>HV – 0 V</i>	-	0 V	0 V	0.2 V
<i>HV – 4 mV</i>	-	5.0 V	4.6 V	4.9 V
<i>HV – 80 mV</i>	-	100.0 V	98.9 V	98.9 V
<i>HV – 800 mV</i>	-	999.3 V	997.0 V	1000.0 V

Special Information regarding to the Candidate:

<i>Was it necessary to:</i>	yes/no	old part (ID/SN)	new part (ID/SN)	information
<i>clean the aerosol inlet</i>	no			
<i>change aerosol Nafion dryer</i>	no			
<i>change sheath Nafion dryer</i>	no			
<i>check source</i>	no			
<i>change HV power supply</i>	no			
<i>clean/change DMA</i>	no			
<i>change aerosol RH/T-sensor</i>	no			
<i>change sheath RH/T-sensor</i>	no			
<i>change pressure sensor</i>	no			
<i>Total CPC</i>	yes			After repair back on the station

PSL Scan and calibration: Latex 203 nm +/- 4 nm

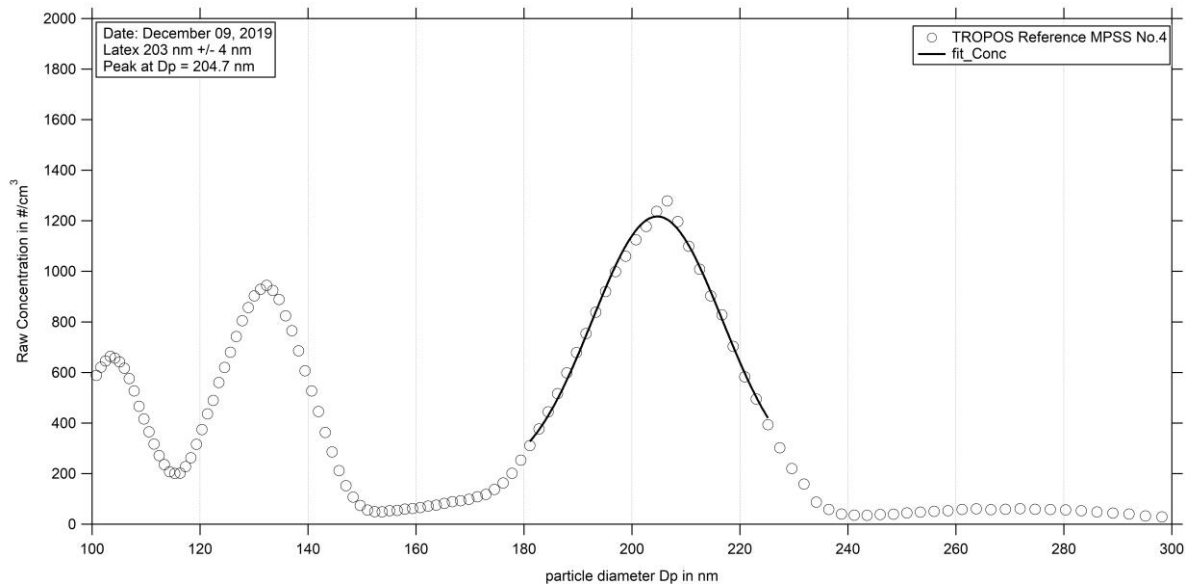


Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on December 9th, 2019.

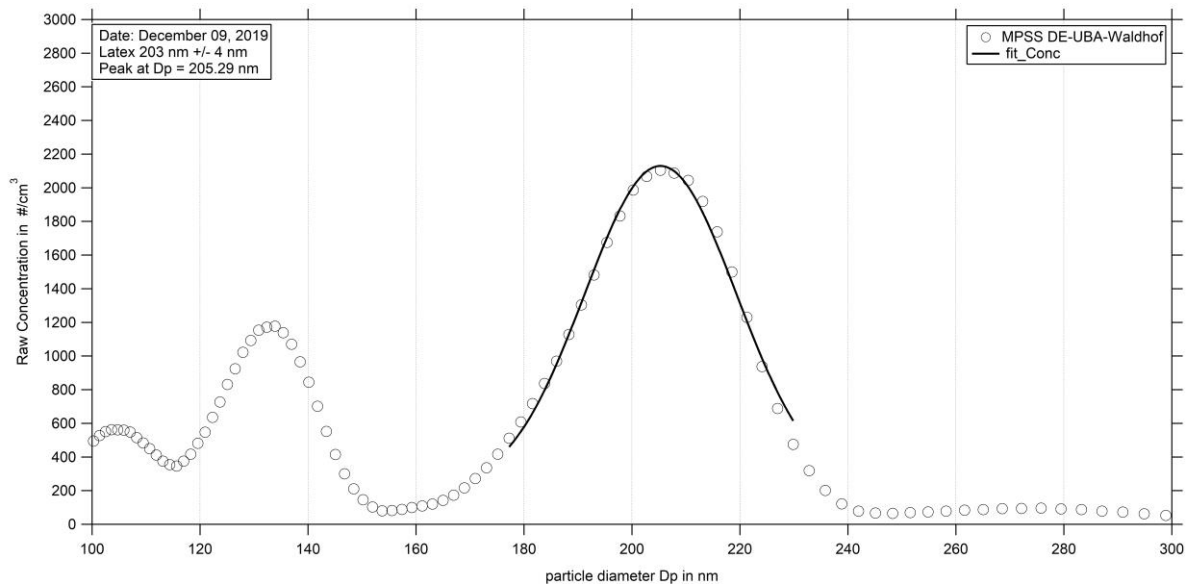


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on December 9th, 2019.

Status of the Candidate: Particle Number Size Distribution

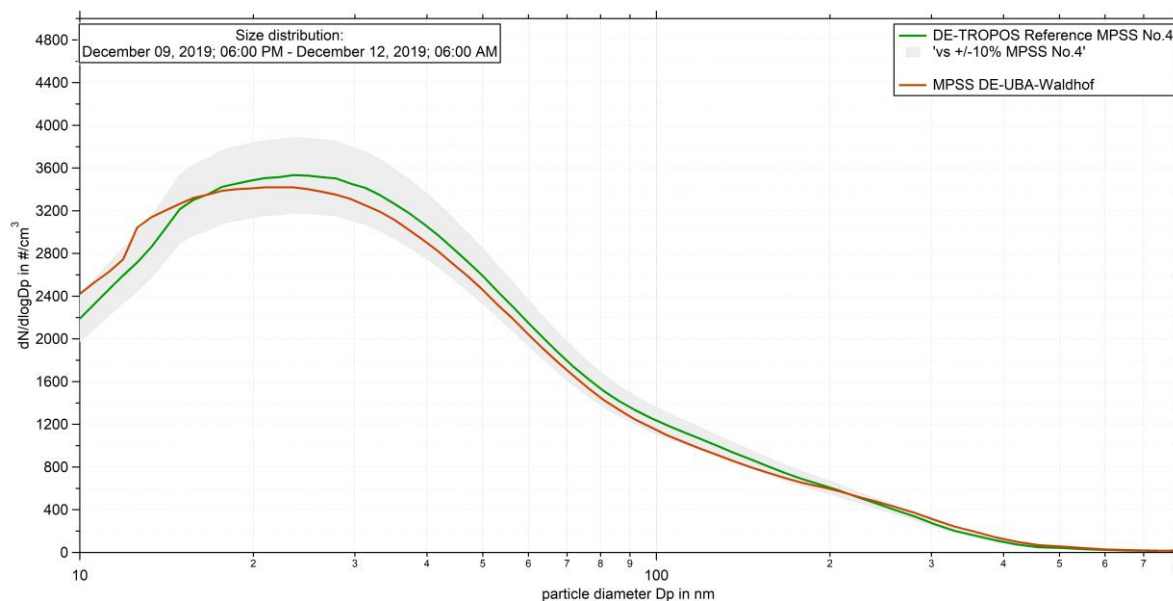


Figure 03: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against DE-UBA-Waldhof from December 09, 2019 18:00 PM until December 12, 2019 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status of the Candidate: Time Series

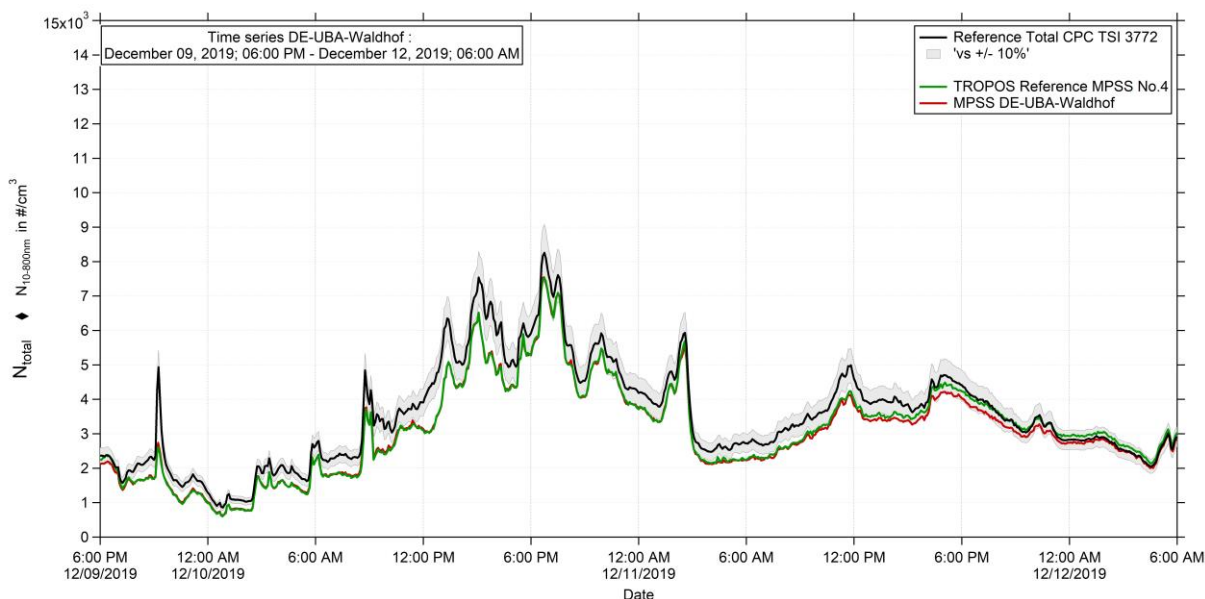


Figure 04: Time series (December 09, 2019 18:00 PM until December 12, 2019 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3772. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the Candidate: Correlation

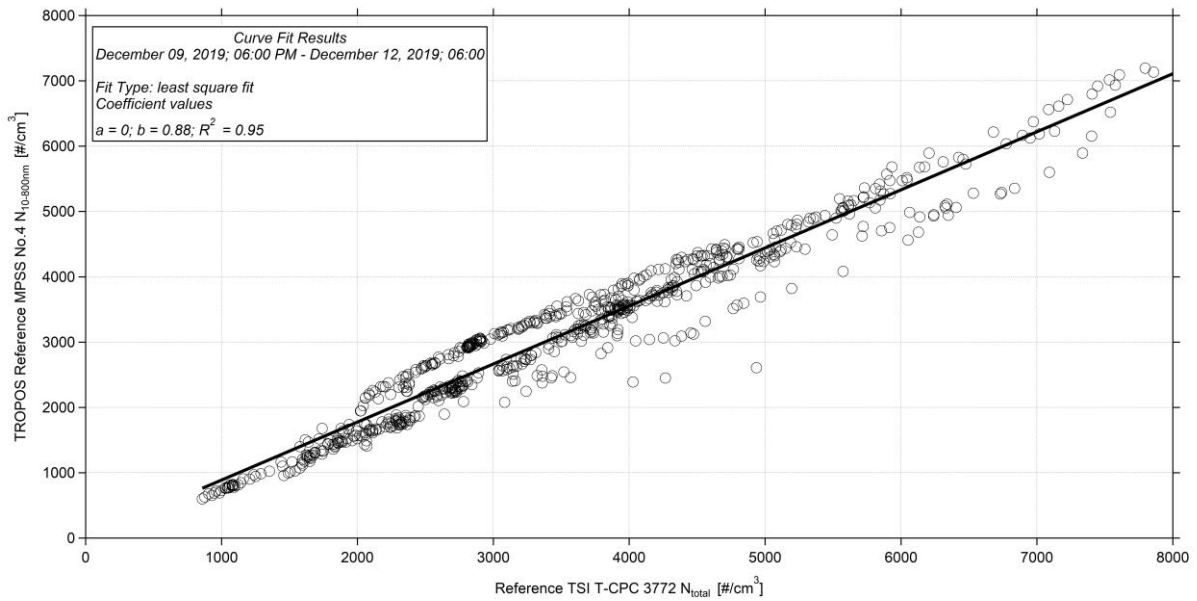


Figure 05: Linear regression between the number concentrations of the TROPOS Reference TSI Total-CPC Model 3772 and DE-TROPOS Reference MPSS No.4. All corrections are included.

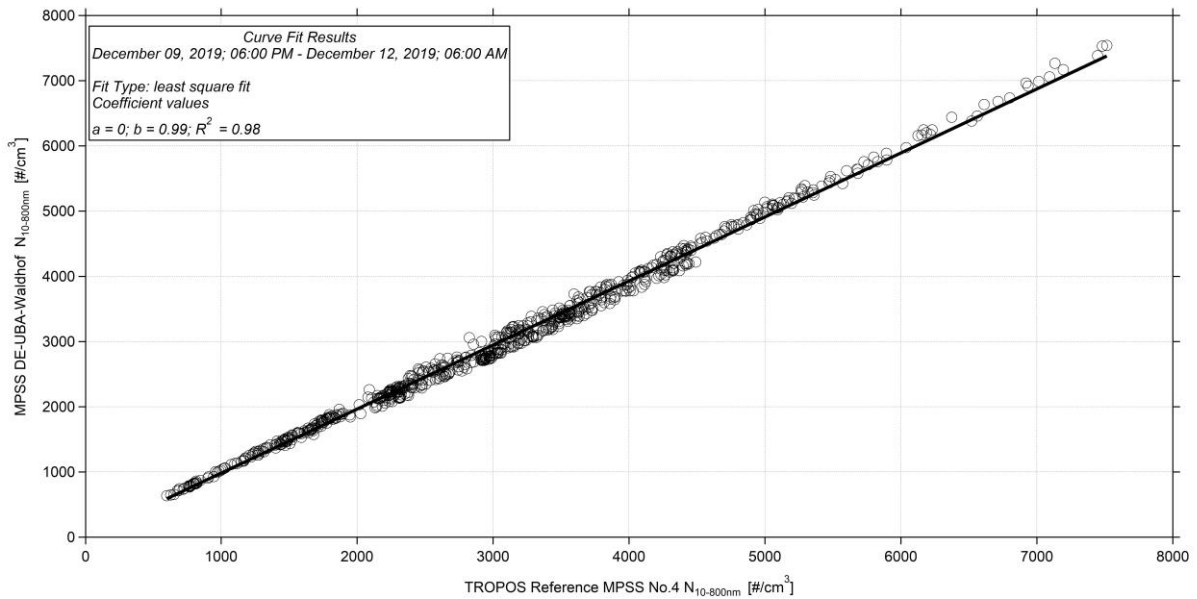


Figure 06: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and MPSS DE-UBA-Waldhof. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

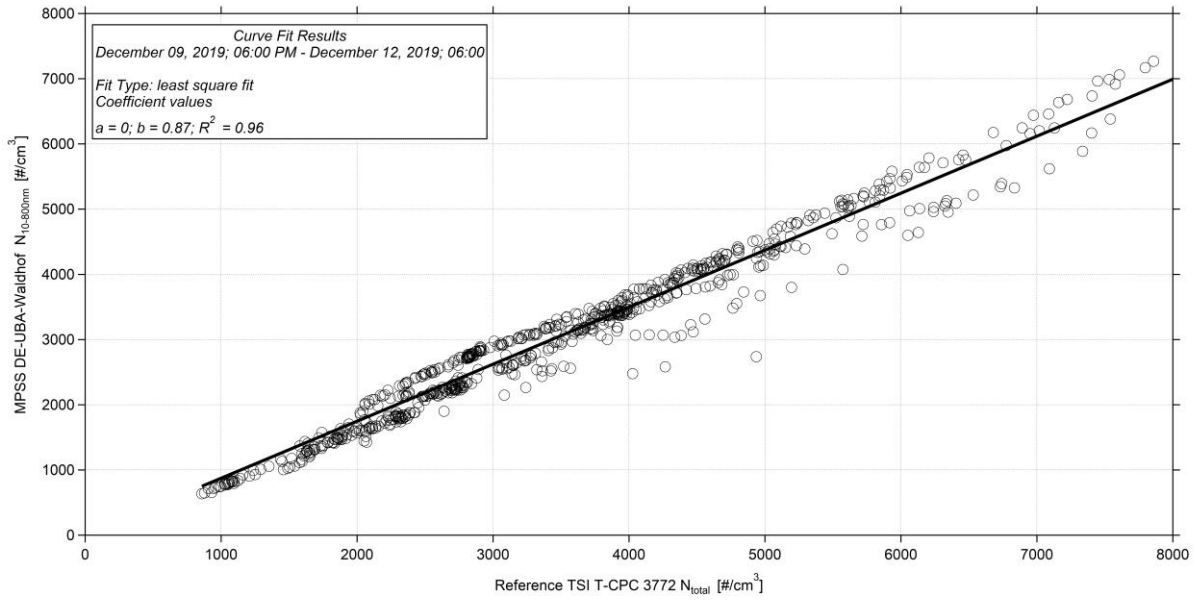


Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI Total-CPC Model 3772 and DE-UBA-Waldhof. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.