

Intercomparison of Mobility Particle Size Spectrometers

Project No.:

Principal Investigator: UBA

Home Institution: UBA

Participant: Olaf Bath

Candidate: **DE-UBA-Neuglobsow**
Made by: TROPOS
Counter (SN): TSI CPC Model 3772, SN: 70944032
Software: TROPOS 6.68
Total CPC: TSI CPC Model 3772, SN: 3772164502

Location of the quality assurance: Station Neuglobsow

Comparison period: December 13, 2019 – January 17, 2020

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: 13.12.2019

<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, Model 3772
<i>CPC-total</i>	TSI CPC, Model 3772	TSI CPC-CEN, 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: 13.12.2019

<i>CPC status</i>	TROPOS-MPSS	TROPOS-total	Candidate-MPSS	Candidate-total
<i>power/status</i>	LED green	LED green	LED green	LED green
<i>saturator temp</i>	39 °C	39 °C	39 °C	39 °C
<i>condenser temp</i>	22 °C	23.5 °C	22.0 °C	23.0 °C
<i>optics temp</i>	40 °C	40 °C	40 °C	40 °C
<i>cabinet temp</i>	30.9 °C	29.7 °C	31.5 °C	31.6 °C
<i>ambient pressure</i>	92.2 kPa	96.1 kPa	96.2 kPa	97.5 kPa
<i>orifice pressure</i>	82.9 kPa	83.9 kPa	82.4 kPa	85.9 kPa
<i>nozzle pressure</i>	2.7 kPa	2.7 kPa	2.6 kPa	0.6 kPa
<i>laser current</i>	59 mA	42 mA	52 mA	41 mA
<i>liquid level</i>	full	full	full	full

Date of check: 13.12.2019

<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	1.014 l/min	-
<i>aerosol flow (DMA)</i>	-	-	-	-
<i>aerosol flow (UDMA)</i>	-	-	-	-
<i>aerosol flow (total)</i>	-	1.024 l/min	1.033 l/min	-
<i>zero</i>	-	0 #/cm ³	2 #/cm ³	-
<i>PSL 203 nm</i>	-	203.0 nm	201.8 nm	-
<i>HV – 0 V</i>	-	0 V	0 V	-
<i>HV – 4 mV</i>	-	4.9 V	4.9 V	-
<i>HV – 80 mV</i>	-	99.9 V	99.6 V	-
<i>HV – 800 mV</i>	-	999.8 V	1000.0 V	-

Date of check: 17.01.2020

<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	1.015 l/min	-
<i>aerosol flow (DMA)</i>	-	-	-	-
<i>aerosol flow (UDMA)</i>	-	-	-	-
<i>aerosol flow (total)</i>	-	1.021 l/min	1.030 l/min	-
<i>zero</i>	-	0 #/cm ³	2 #/cm ³	-
<i>PSL 203 nm</i>	-	203.0 nm	201.8 nm	-
<i>HV – 0 V</i>	-	0 V	0.1 V	-
<i>HV – 4 mV</i>	-	4.92 V	4.96 V	-
<i>HV – 80 mV</i>	-	99.8 V	99.6 V	-
<i>HV – 800 mV</i>	-	1000.0 V	1000.0 V	-

Date of check: 17.01.2020

<i>CPC status</i>	TROPOS-MPSS	TROPOS-total	Candidate-MPSS	Candidate-total
<i>power/status</i>	LED green	LED green	LED green	LED green
<i>saturator temp</i>	39 °C	39 °C	39 °C	39 °C
<i>condenser temp</i>	22 °C	23.5 °C	22.0 °C	23.0 °C
<i>optics temp</i>	40 °C	40 °C	40 °C	40 °C

<i>cabinet temp</i>	35.2 °C	33.0 °C	31.4 °C	31.3°C
<i>ambient pressure</i>	100.7 kPa	99.6 kPa	100.4 kPa	101.0 kPa
<i>orifice pressure</i>	86.0 kPa	86.6 kPa	86.1 kPa	89.0 kPa
<i>nozzle pressure</i>	2.7 kPa	2.8 kPa	2.7 kPa	0.6 kPa
<i>laser current</i>	59 mA	42 mA	52 mA	41 mA
<i>liquid level</i>	full	full	full	full

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>	no			

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

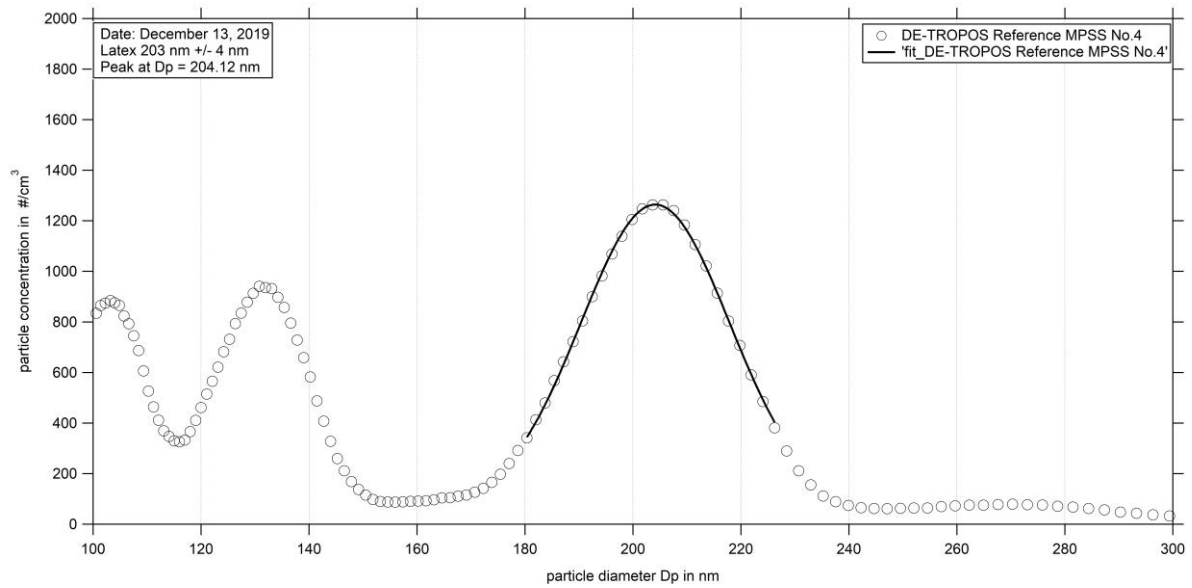


Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on December 13th, 2019.

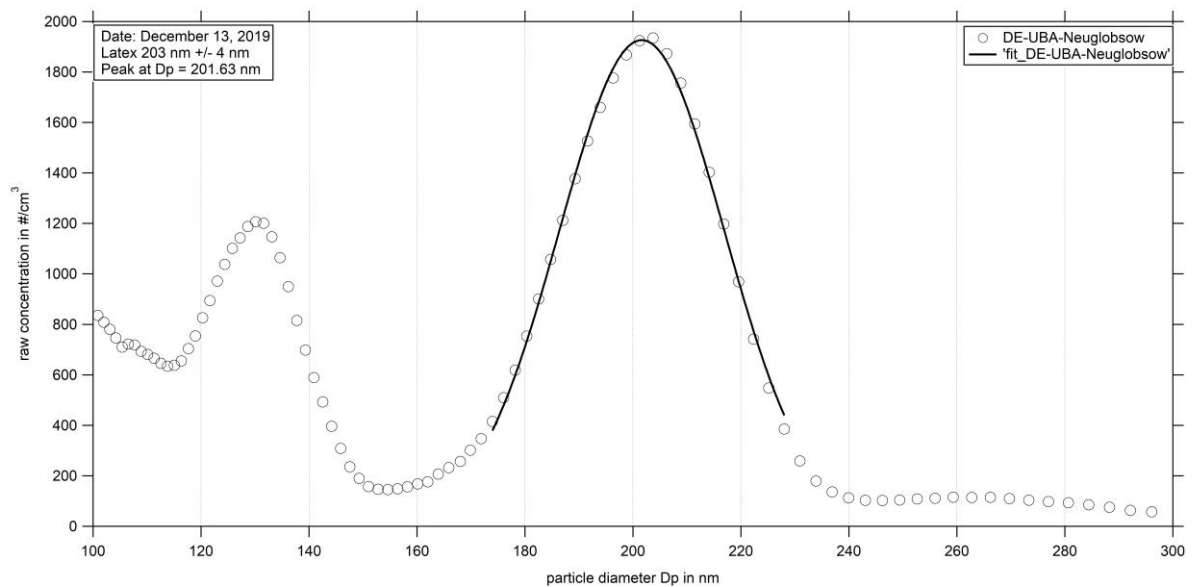


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on December 13th, 2019.

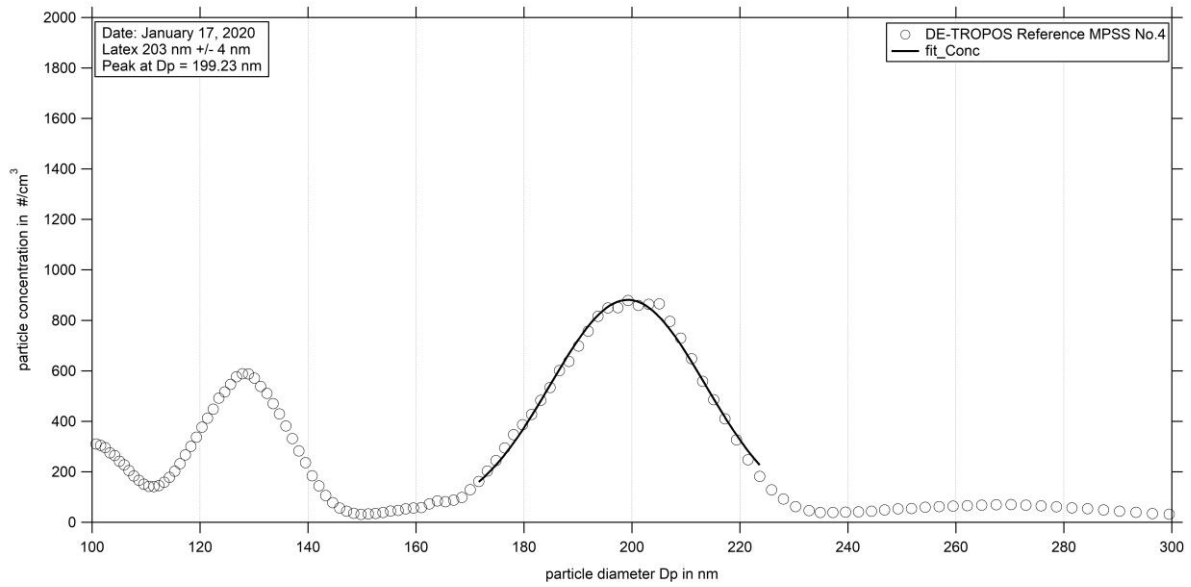


Figure 03: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on January 17th, 2020.

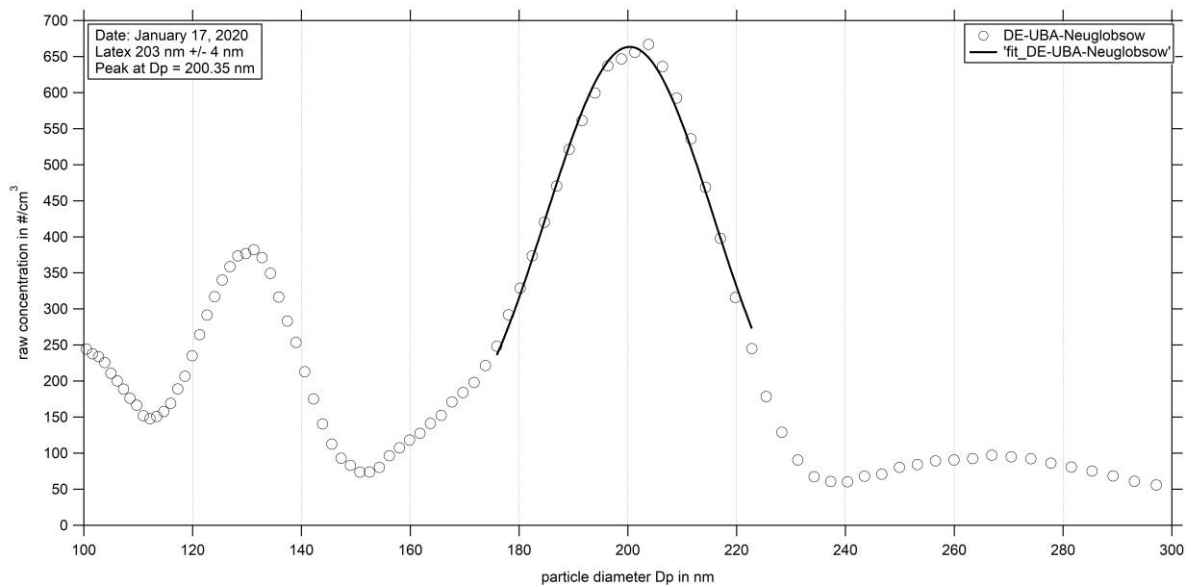


Figure 04: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on January 17th, 2020.

Status of the Candidate: Particle Number Size Distribution

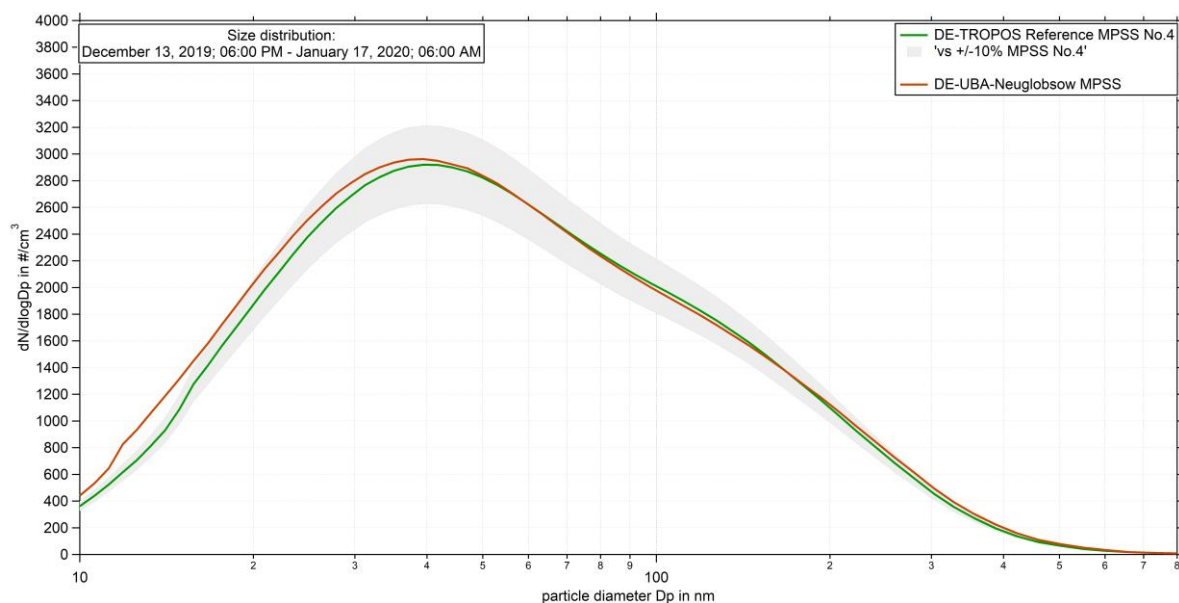


Figure 05: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against DE-UBA-Neuglobsow from December 13, 2019 18:00 PM until January 17, 2020 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included for both instruments.

Status of the Candidate: Time Series

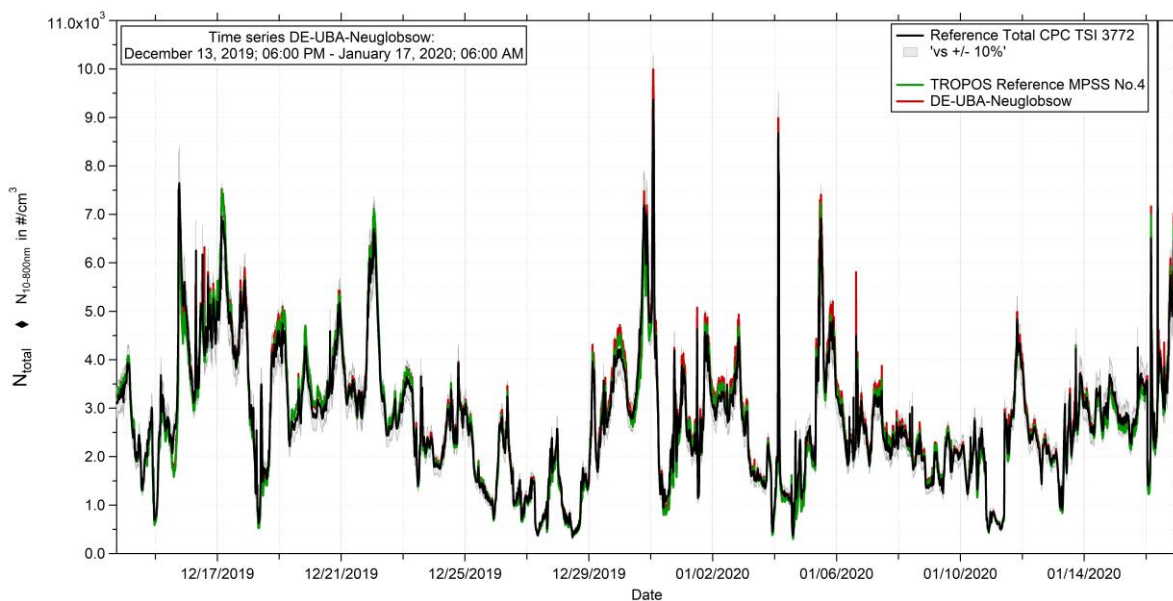


Figure 04: Time series (December 13, 2019 18:00 PM until January 17, 2020 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3772. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the Candidate: Correlation

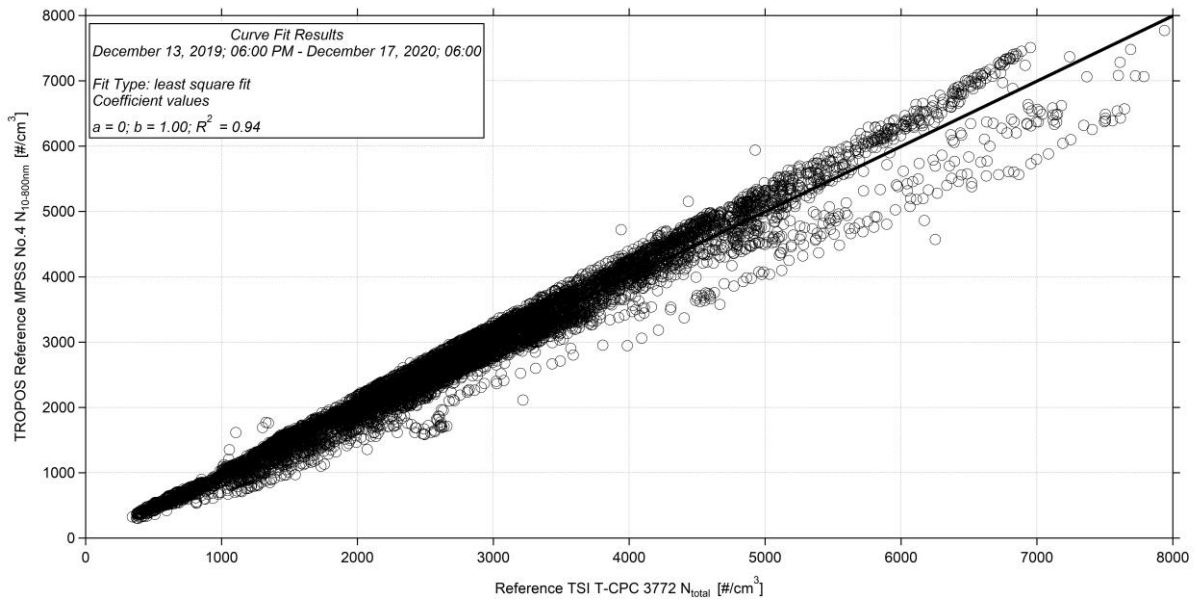


Figure 05: Linear regression between the number concentrations of the TROPOS Reference TSI Total-CPC Model 3772 and TROPOS Reference MPSS No.4. All corrections are included.

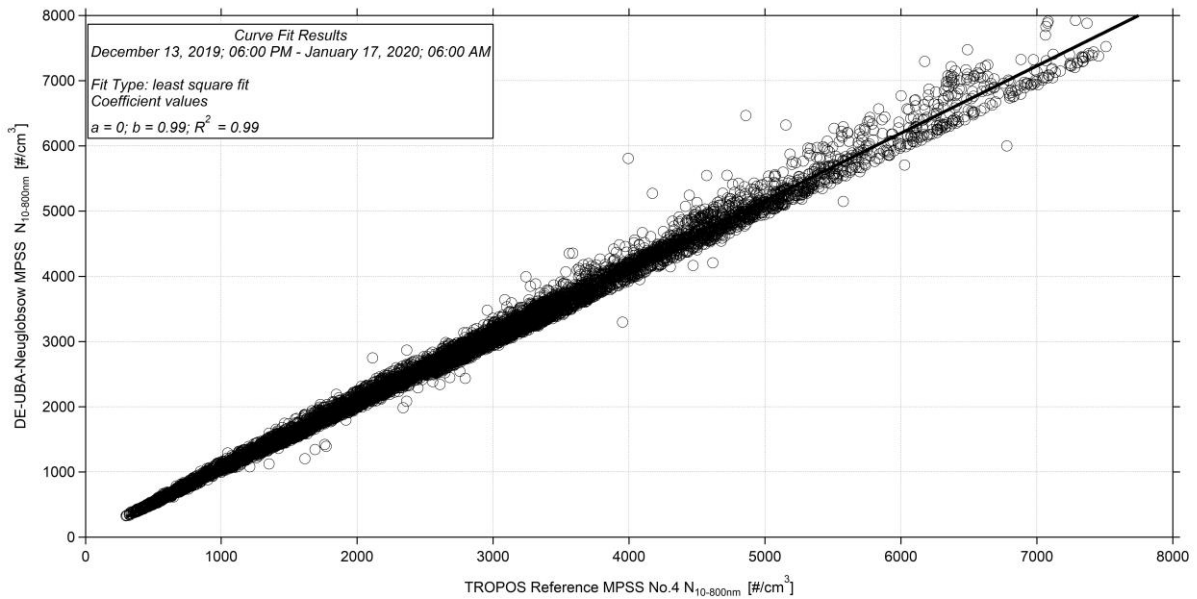


Figure 06: Linear regression between the number concentrations of the MPSS DE-UBA-Neuglobsow and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

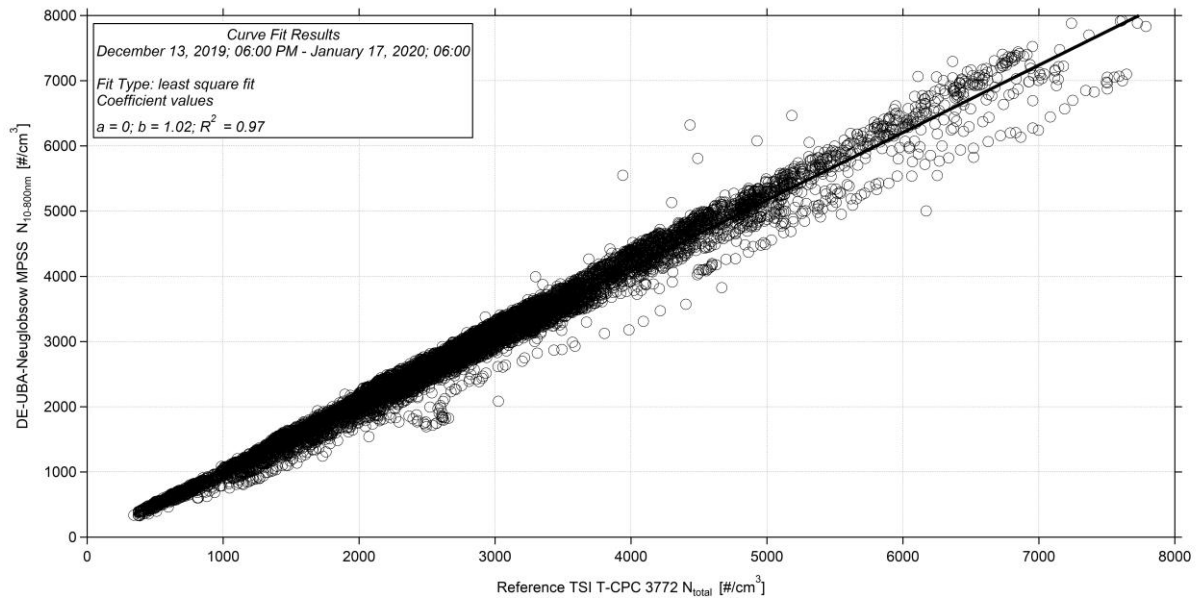


Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI Total-CPC Model 3772 and MPSS DE-UBA-Neuglobsow. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.