

Intercomparison of Mobility Particle Size Spectrometers

<i>Project No.:</i>	<i>OSIA-2019-1-3</i>
<i>Principal Investigator:</i>	<i>UBA</i>
<i>Home Institution:</i>	<i>UBA</i>
<i>Participant:</i>	<i>Ralf Sohmer</i>
<i>Candidate:</i>	DE-UBA-Zugspitze
<i>Made by:</i>	TROPOS
<i>Counter (SN):</i>	TSI CPC Model 3772, SN: 3772161407 (April 2016)
<i>Software:</i>	TROPOS 6.68
<i>Total CPC:</i>	TSI CPC Model 3772, SN: 70640111 (October 2006)
<i>Location of the quality assurance:</i>	Station Zugspitze
<i>Comparison period:</i>	February 12, 2020 – February 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: 12.02.2020

<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	Ni63
<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: 12.02.2020

<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>saturation temp</i>	39 °C	39 °C	39 °C	39 °C
<i>condenser temp</i>	22 °C	23.8 °C	22.0 °C	23.5 °C
<i>optics temp</i>	40 °C	40 °C	40 °C	40 °C
<i>cabinet temp</i>	32.0 °C	29.6 °C	32.4 °C	33.7 °C
<i>ambient pressure</i>	72.8 kPa	71.2 kPa	72.6 kPa	71.9 kPa
<i>orifice pressure</i>	53.1 kPa	53.4 kPa	56.1 kPa	57.4 kPa
<i>nozzle pressure</i>	2.0 kPa	2.0 kPa	1.9 kPa	1.7 kPa
<i>laser current</i>	59 mA	42 mA	42 mA	40 mA
<i>liquid level</i>	full	full	full	full

Date of check: 12.02.2020

<i>date</i>	TROPOS Reference MPSS		Candidate	
	pre-audit status	final-audit status	pre-audit status	final-audit status
<i>total CPC flow</i>	-	1.026 l/min	1.016 l/min	-
<i>aerosol flow (DMA)</i>	-	-	-	-
<i>aerosol flow (UDMA)</i>	-	-	-	-
<i>aerosol flow (total)</i>	-	1.001 l/min	1.015 l/min	-
<i>zero</i>	-	0 #/cm ³	0 #/cm ³	-
<i>PSL 203 nm</i>	-	205.25 nm	205.42 nm	-
<i>HV – 0 V</i>	-	0 V	0 V	-
<i>HV – 4 mV</i>	-	5.0 V	5.1 V	-
<i>HV – 80 mV</i>	-	100.2 V	100.2 V	-
<i>HV – 800 mV</i>	-	999.6 V	999.7 V	-

Date of check: 17.02.2020

<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>	-	-	-	-
<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: 17.02.2020

<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

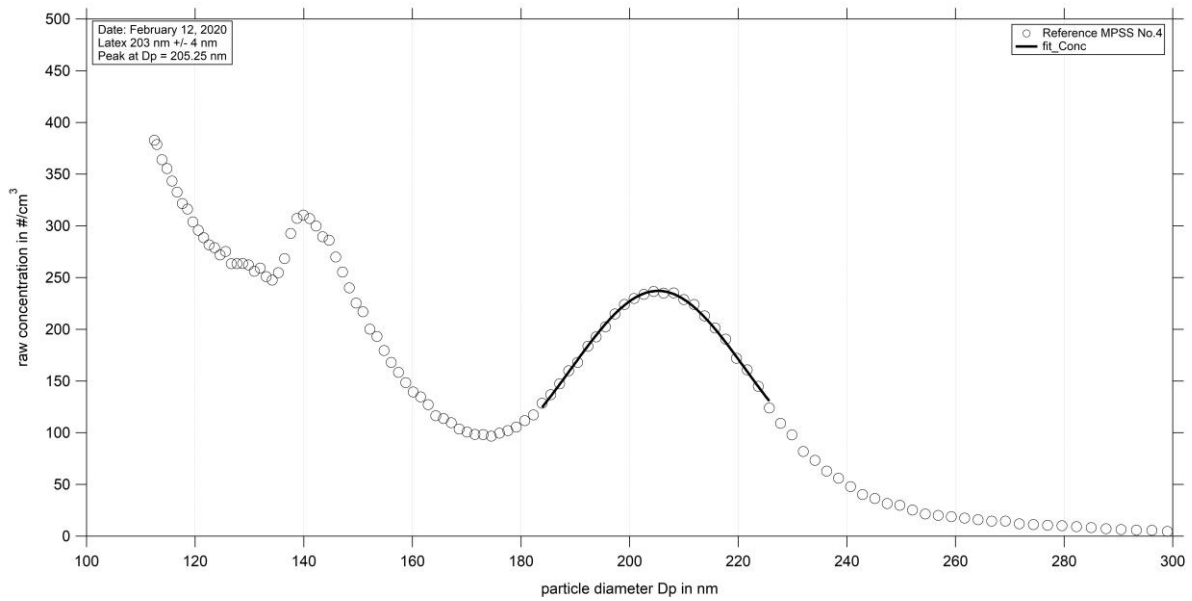


Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on February 12th, 2020.

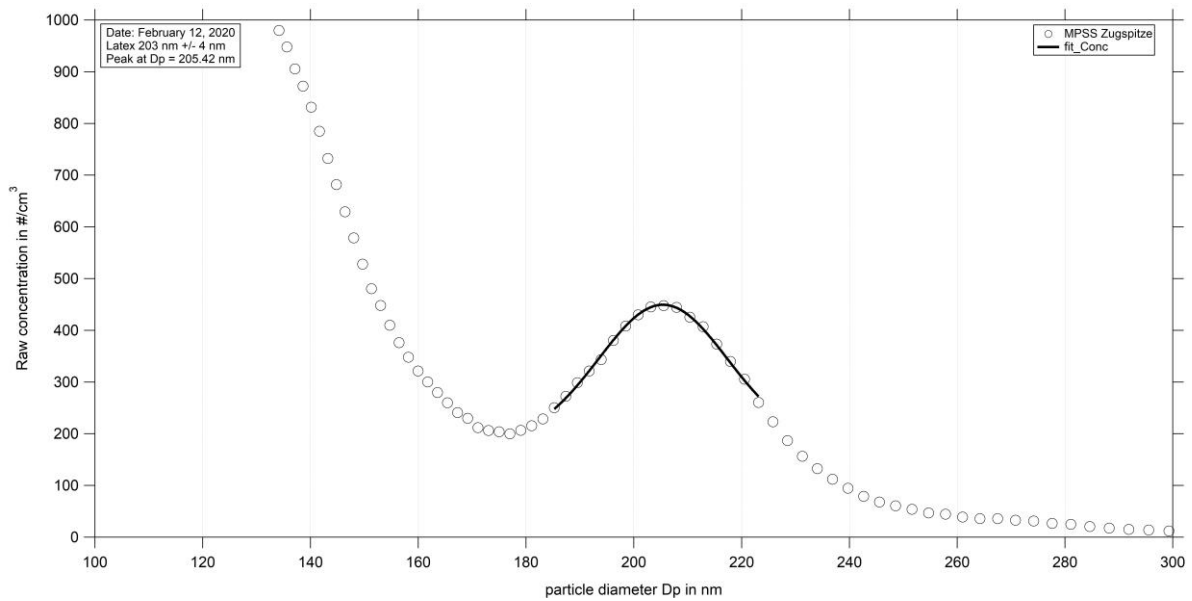


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on February 12th, 2020.

Status of the Candidate: Particle Number Size Distribution

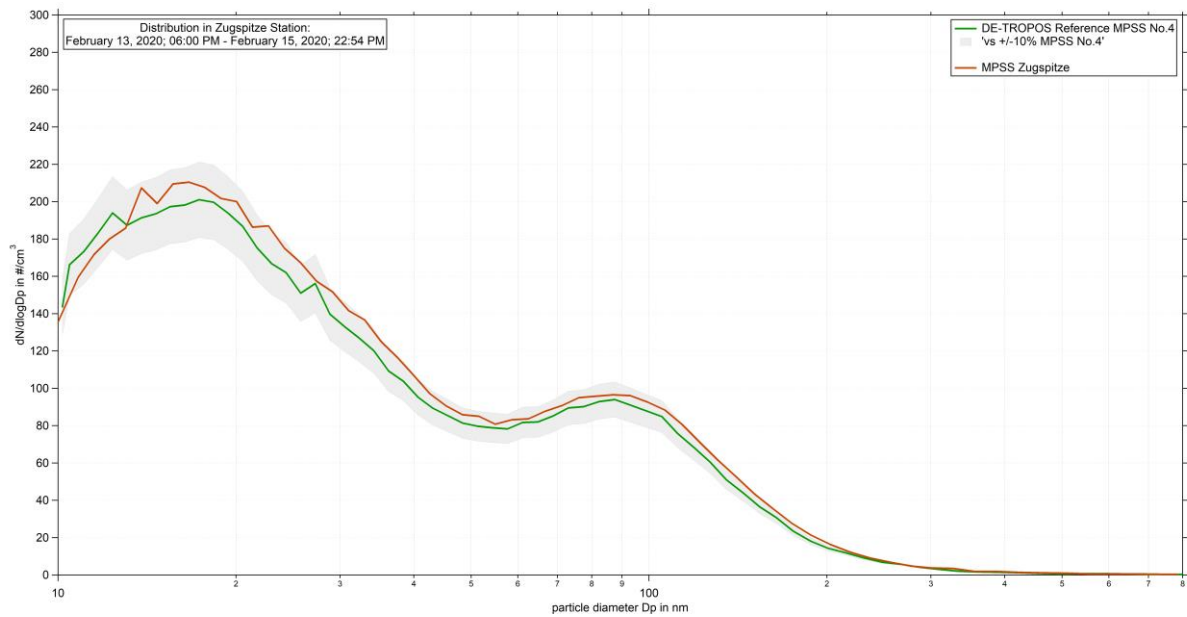


Figure 03: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against DE-UBA-Zugspitze from February 12, 2020 18:00 PM until February 15, 2020 22:54 PM. Multiple charge correction, internal diffusion losses and CPC efficiency are included for both of the instruments.

Status of the Candidate: Time Series

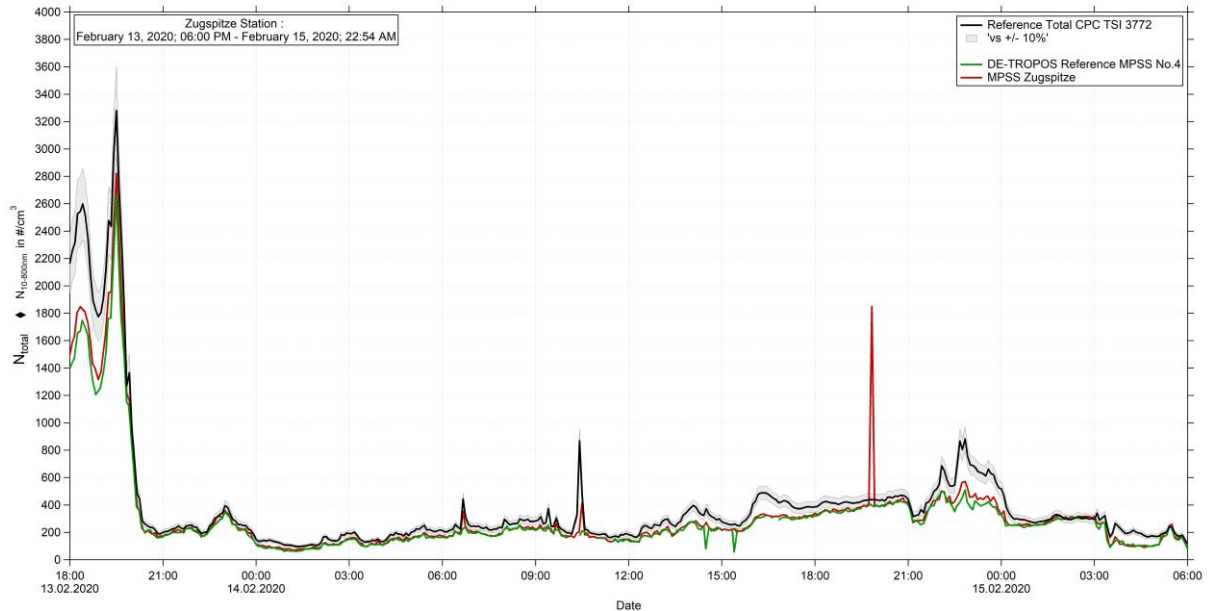


Figure 04: Time series (February 12, 2020 18:00 PM until February 15, 2020 22:54 PM) of the integrated particle number concentration (N10-800nm) of the MPSS and total number concentration (Ntotal) of the reference TSI-CPC Model 3772. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the Candidate: Correlation

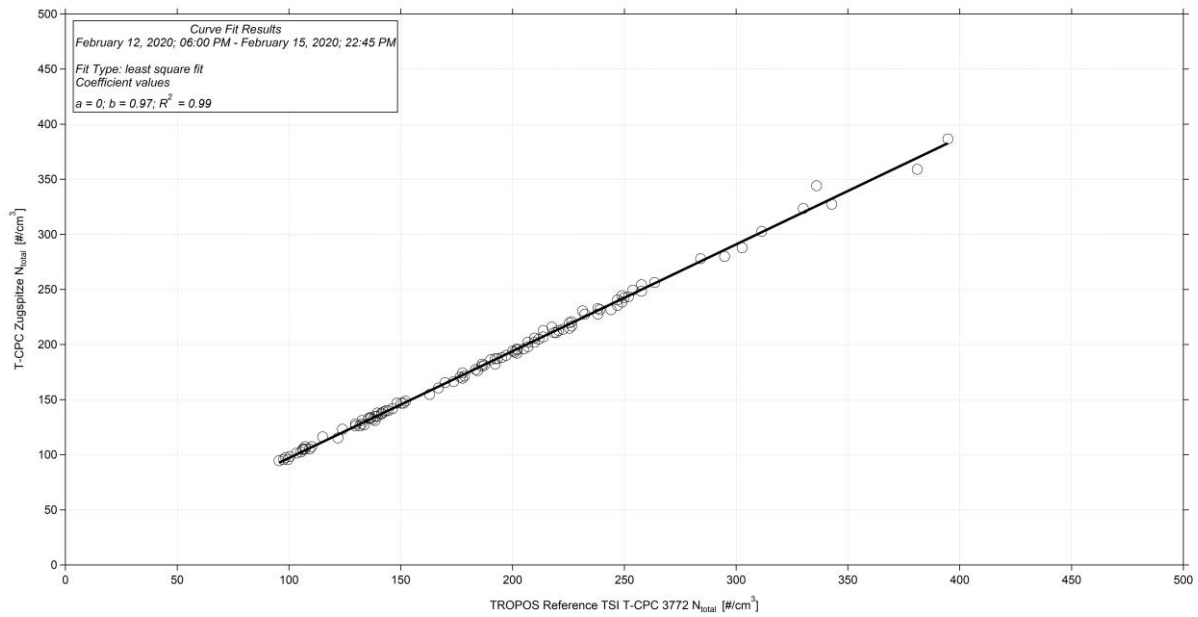


Figure 05: Linear regression between the number concentrations of the TROPOS Reference TSI Total-CPC Model 3772 and Total CPC 3772 Zugspitze. All corrections are included.

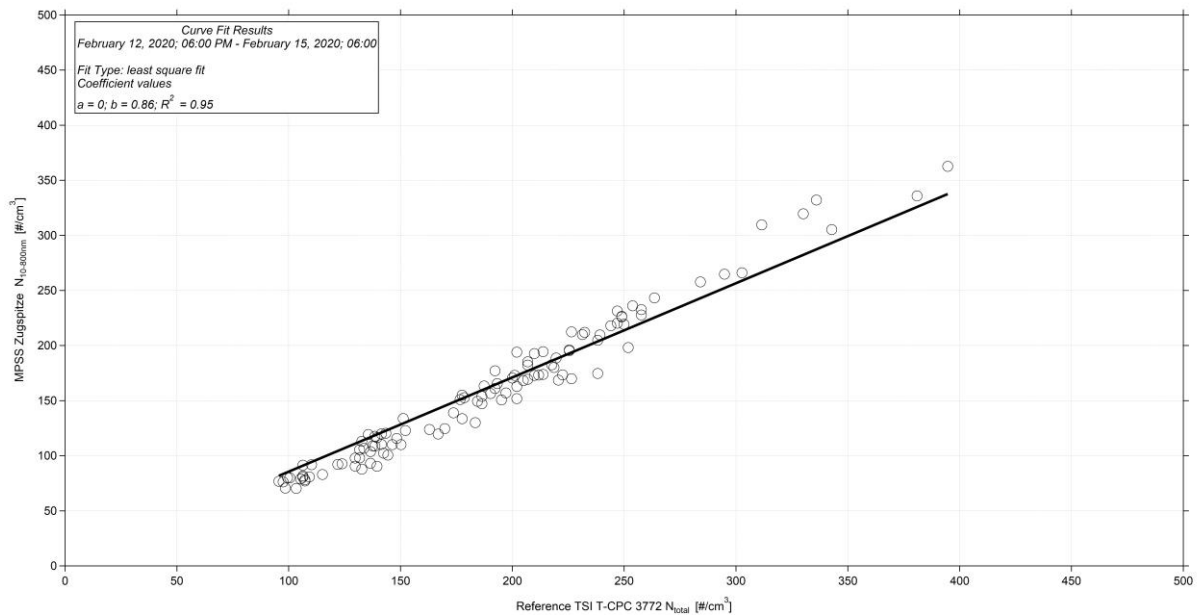


Figure 05: Linear regression between the number concentrations of the TROPOS Reference TSI Total-CPC Model 3772 and DE-UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

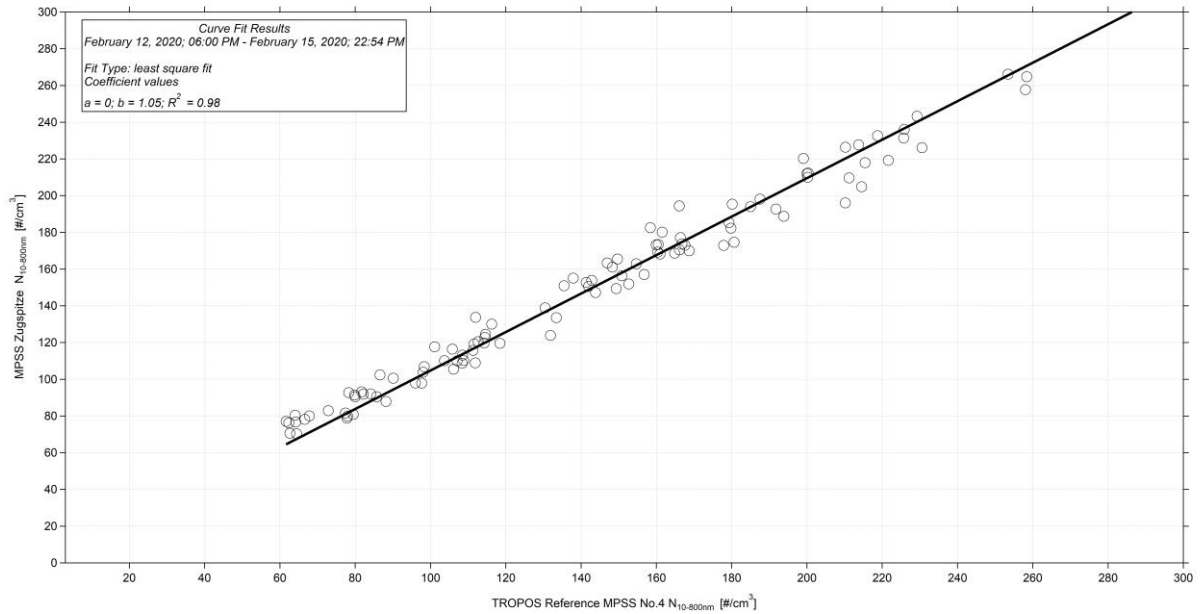


Figure 06: Linear regression between the number concentrations of the TROPOS Reference instrument No.4 and DE-UBA-Zugspitze. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

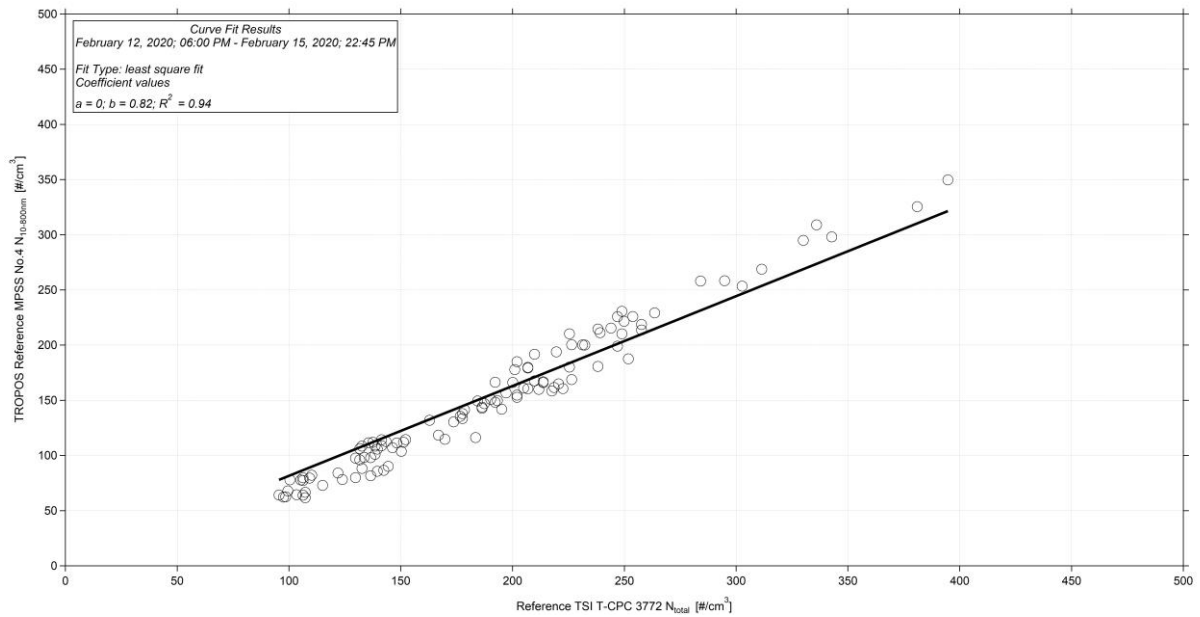


Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI Total-CPC Model 3772 and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.