Intercomparison of Mobility Particle Size Spectrometers

Project No.:	*MPSS-2018-2-2*
Principal Investigator:	Wolfram Birmili
Home Institution:	*Umweltbundesamt (UBA)*
Participant:	
Candidate:	**UBA**
Made by:	**TSI**
Counter (SN):	TSI-WCPC 3787
Software:	TSI Software 10.2
Location of the quality assurance:	TROPOS Leipzig, lab 118
Comparison period:	March 12, 2018 – April 19, 2018
Last Intercomparison (with Project No.):	

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Mitglied der Leibniz-Gemeinschaft

Summary of Intercomparison:

Pre-Status:
The candidate arrived with participant. It was not possible to check the Pre-Status of the candidate because the used TSI WCPC 3787 had technical problems from the beginning and was completely broken after the CPC-workshop. TROPOS was not able to fix the CPC during the workshop week. The candidate had to come back for a second intercomparison. Nonetheless, to check the performance and function of the classifier, a TSI CPC 3772 from TROPOS was used,which are shown in the plots below. The candidate was running well and showed reasonable results. The sizing check with PSL showed a peak at 204 nm.

Final-Status:
The final run took part in April 2018. During the Final-Status, the performance of the system showed a concentration within the +/-10% of the TROPOS Reference Instrument No.6. The candidate used the repaired TSI CPC model 3787 and their own source. The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments:
Date of check: March 12, 2018

List of Components	TROPOS Reference MPSS No.6		Candidate
Position	Line 1		Line 1
Company	TROPOS		TSI
Software	TROPOS		TSI AIM 10.2
CPC-MPSS	TSI CPC, Model 3772		TSI WCPC 3787
CPC-total	TSI CPC, Model 3010		TSI WCPC 3787
flow ratio	1.0 : 5.0		0.6:3
source	Ni.63		x-ray
HV power supply	Positive		Negative
DMA	Hauke medium		-
aerosol dryer	✓		-
aerosol RH- sensor	✓		-
aerosol T-sensor	✓		✓
sheath RH-sensor	✓		-
sheath T-sensor	✓		-
Sheath dryer	✓		-
pressure sensor	✓		✓
info			

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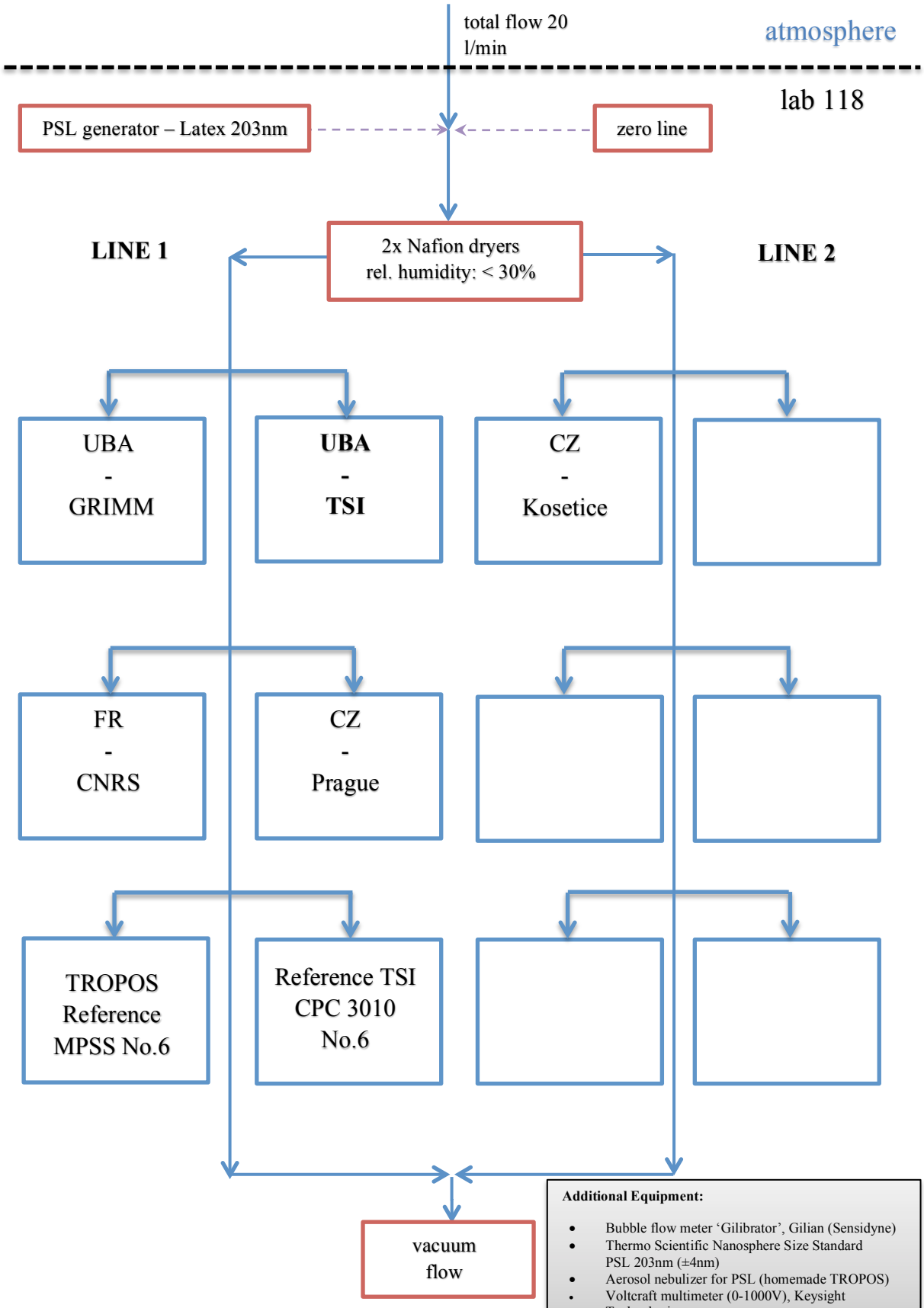
Laboratory setup:



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Status of the instruments:

Date of system checks:

date	12.03.2018	13.03.2018	14.03.2018	15.03.2018	unit
total CPC flow	-	-	-	-	l/min
aerosol flow (DMA)	-	-	-	-	l/min
aerosol flow (UDMA)	-	-	-	-	l/min
aerosol flow (total)	0.534	0.5298	1.000 (TROPOS TSI 3772)	-	l/min
Zero MPSS	0			-	#/cm³
Zero total CPC	✓				#/cm³
PSL 203 nm	✓				nm
HV check					V

Special Information regarding the Candidate:

Was it necessary to:	yes/no (date)	old part (ID/SN)	new part (ID/SN)	information
clean the aerosol inlet	No	-	-	checked
change aerosol Nafion dryer	No	-	-	
change sheath Nafion dryer	No	-	-	
check source	No	-	-	checked
change HV power supply	No	-	-	checked
clean/change DMA	No	-	-	checked
change aerosol RH/T-sensor	No	-	-	
change sheath RH/T-sensor	No	-	-	
change pressure sensor	No	-	-	
change inlet Nafion dryer (500)	No	-	-	
Change Total filter	No	-	-	
NI-card	No			

13.03.18: changed CPC. New CPC from TROPOS SN: 70835060. New Flow: 996.2 l/min

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

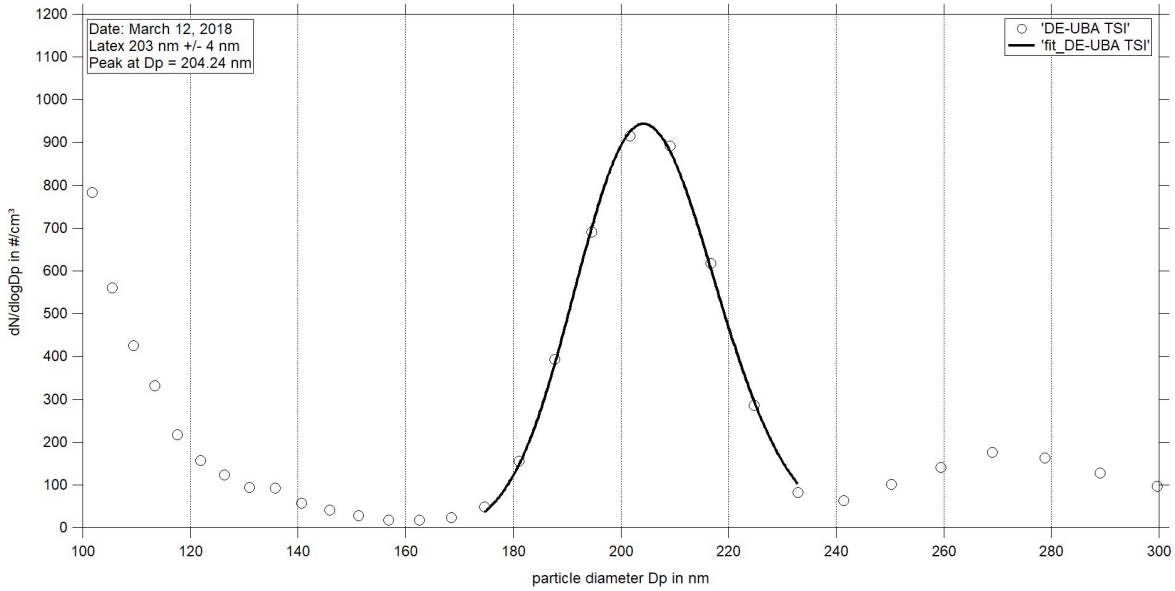

Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on Mar 12, 2018.

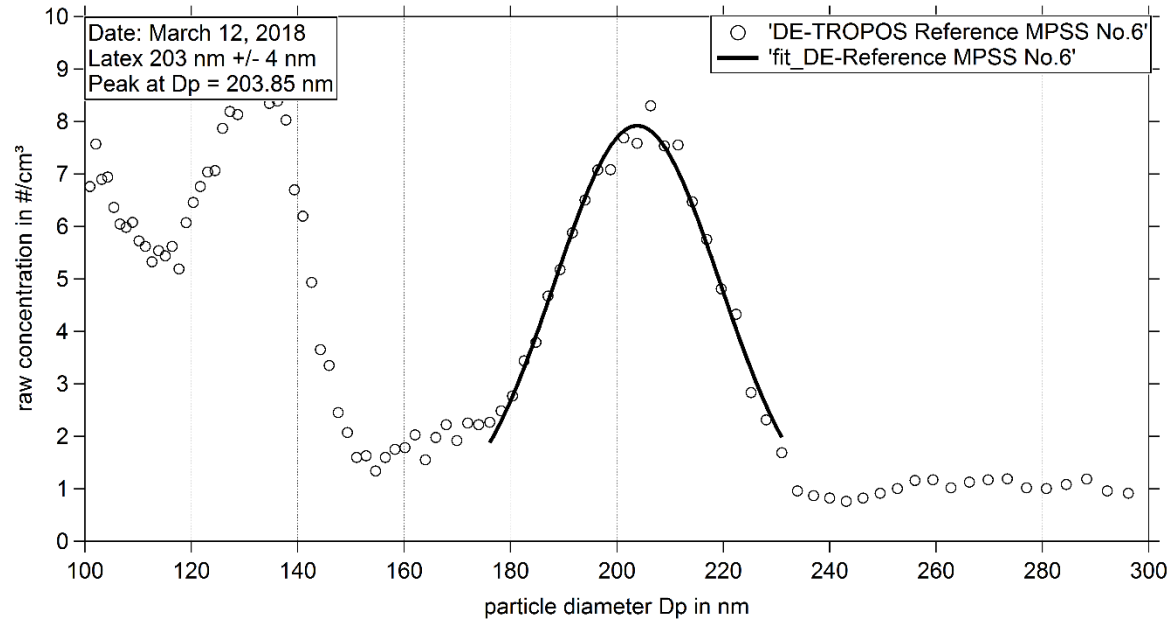

Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on Mar 12, 2018.

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Status of the TROPOS Reference Instruments in February: Particle Number Size Distribution, Time Series and Correlation

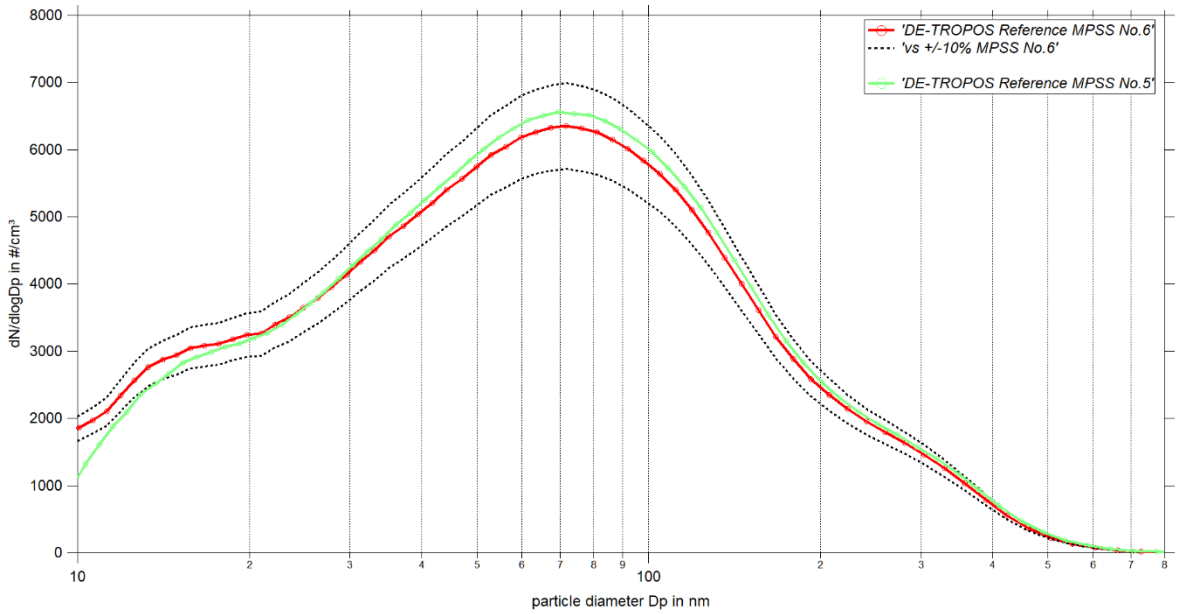

Figure 03: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.6 against TROPOS Reference MPSS No.5 from February 19, 2018 08:00 PM – February 20, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

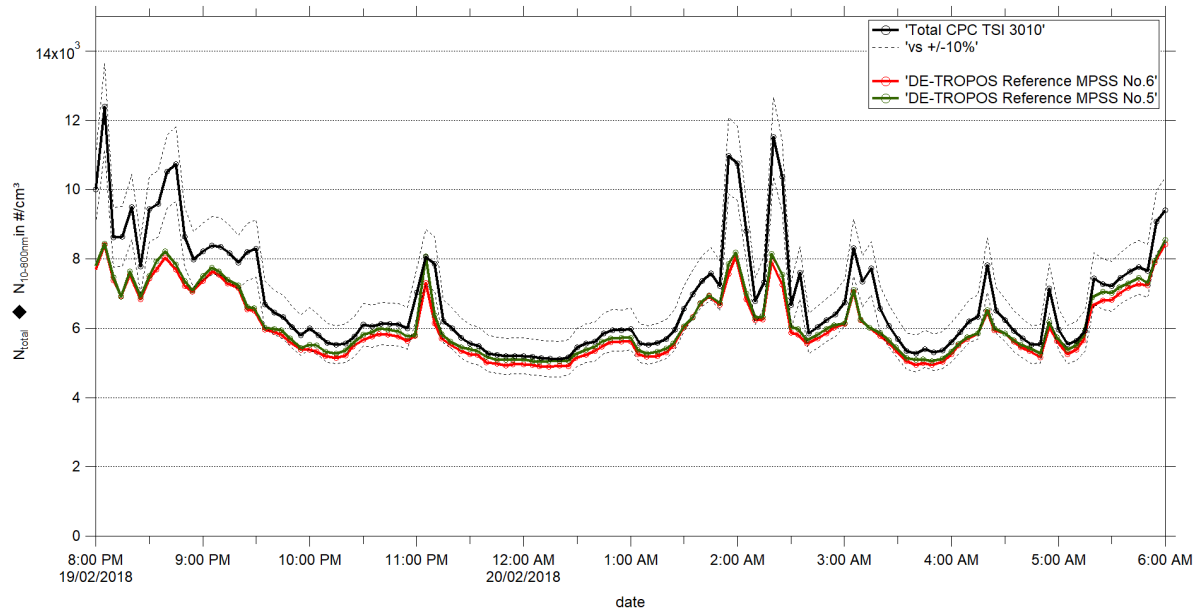

Figure 04: Time series (February 19, 2018 08:00 PM – February 20, 2018 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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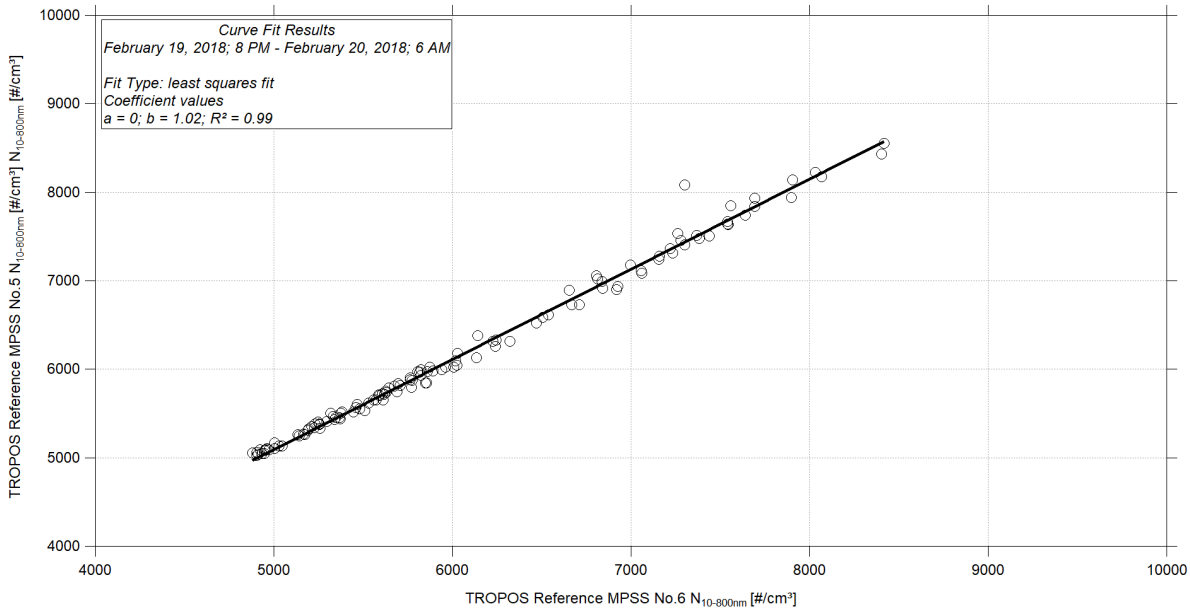

Figure 05: Linear regression between the number concentrations of the TROPOS Reference MPSS No.6 and TROPOS Reference MPSS No.5. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the TROPOS Reference Instruments: Particle Number Size Distribution

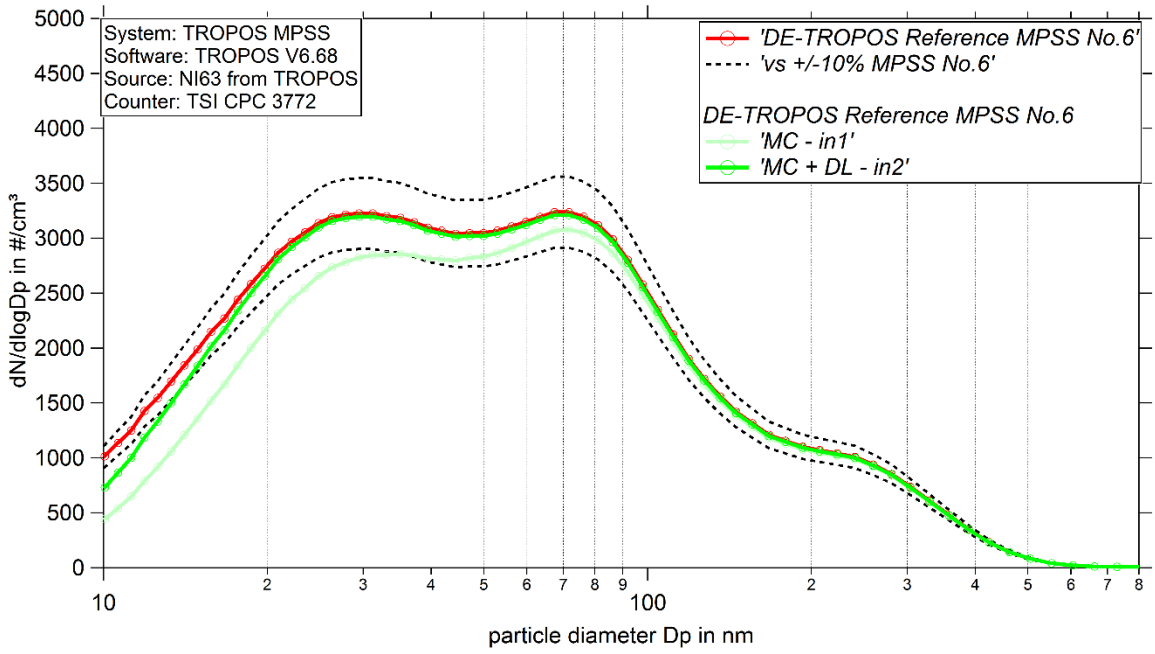

Figure 06: Comparison of mean particle number size distribution of TROPOS Reference TSI CPC Model 3010 Ref 6 against TROPOS Reference MPSS No.6 from March 12, 2018 08:00 PM – March 13, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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Status of the TROPOS Reference Instruments: Time Series

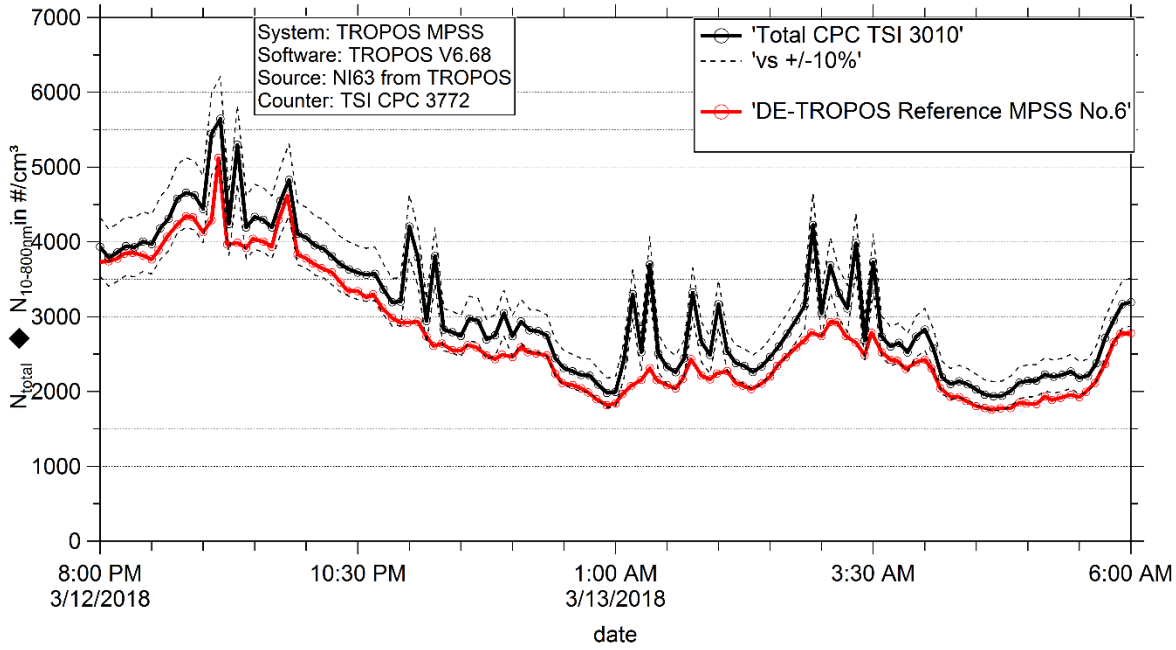

Figure 07: Time series (March 12, 2018 08:00 PM – March 13, 2018 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the TROPOS Reference Instruments: Correlation

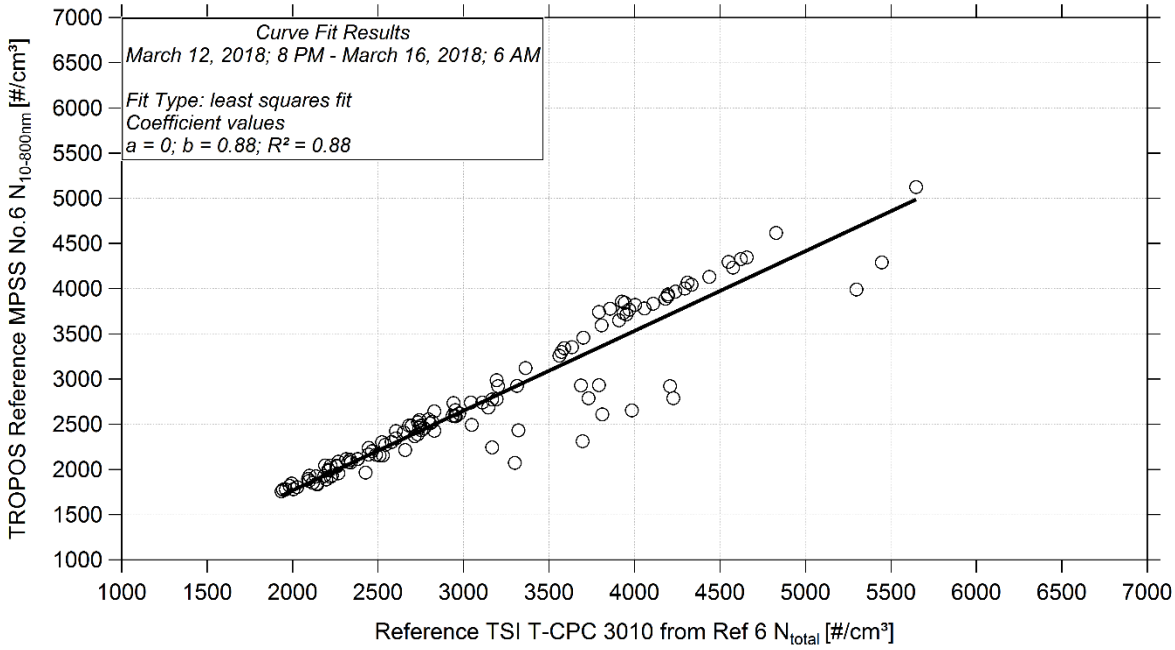

Figure 08: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and TROPOS Reference MPSS No.6. Multiple charge correction, internal diffusion losses and CPC flow corrections are included

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Pre-Status of the Candidate: Particle Number Size Distribution

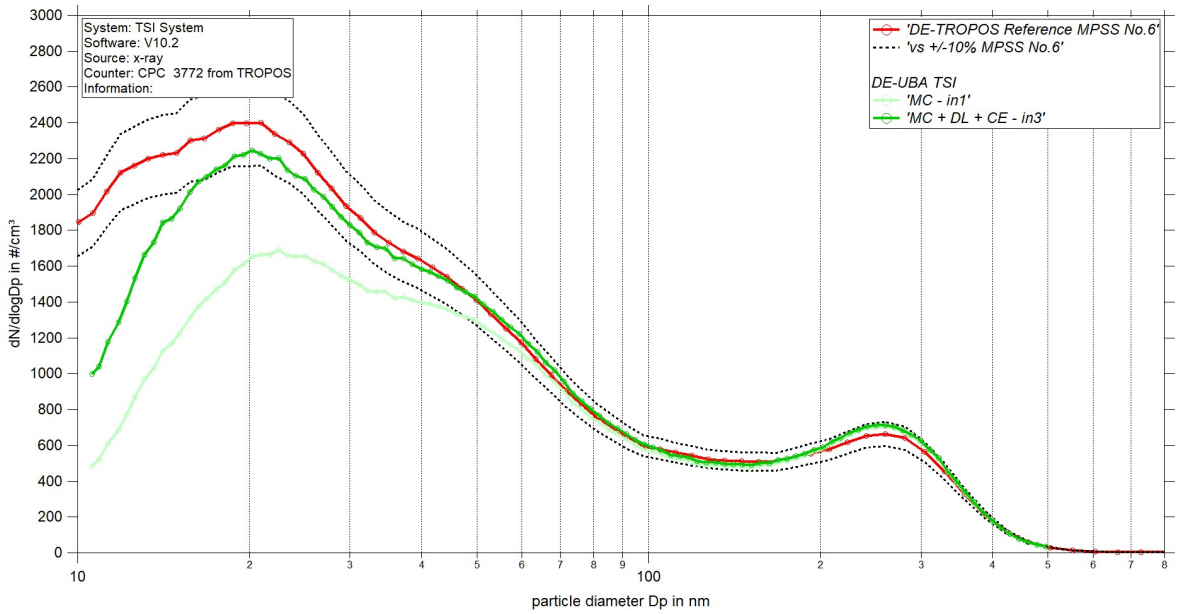

Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.6 against UBA-TSI from March 13, 2018 08:00 PM – March 14, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included. The candidate is using a TROPOS TSI CPC 3772.

Pre-Status of the Candidate: Time Series and Correlation

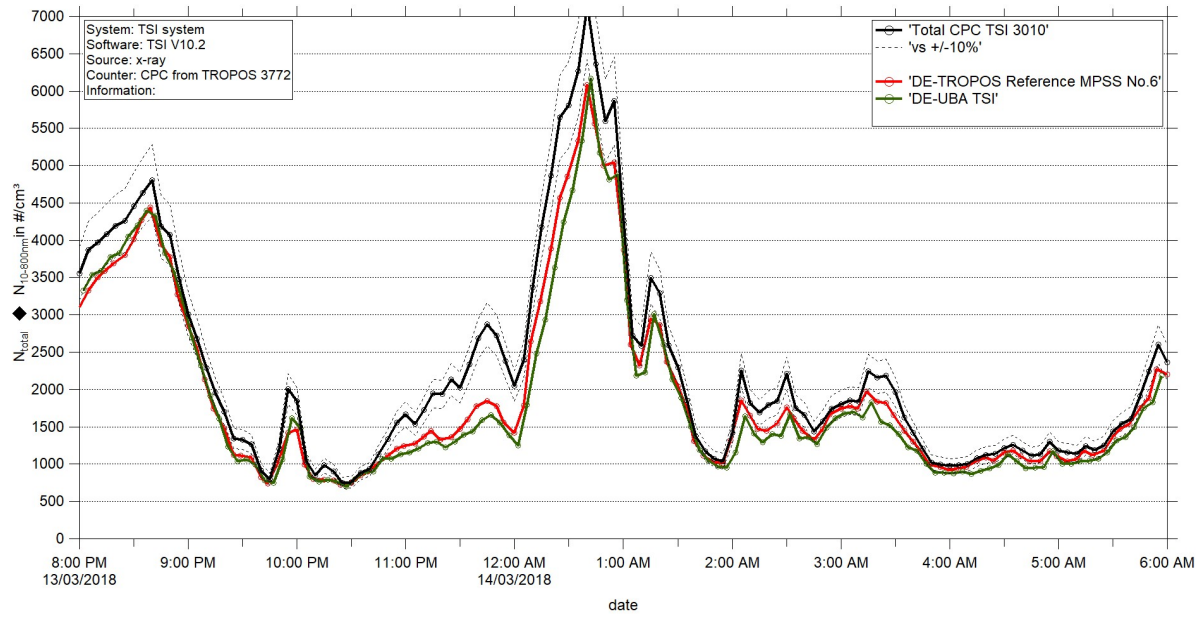

Figure 10: Time series (March 12, 2018 08:00 PM – March 13, 2018 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion and corrections for the candidate was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included. The candidate is using a TROPOS TSI CPC 3772.

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Final-Status of the Candidate: Particle Number Size Distribution

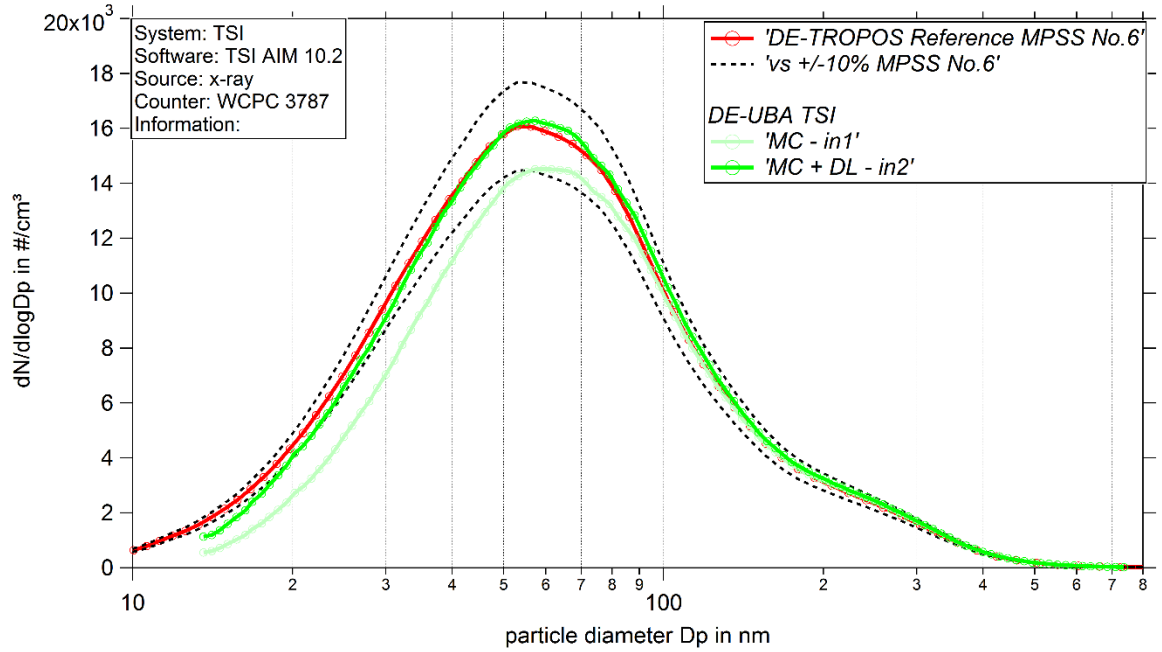

Figure 11: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.6 against UBA-TSI from April 18, 2018 08:00 PM – April 19, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final-Status of the Candidate: Time Series and Correlation

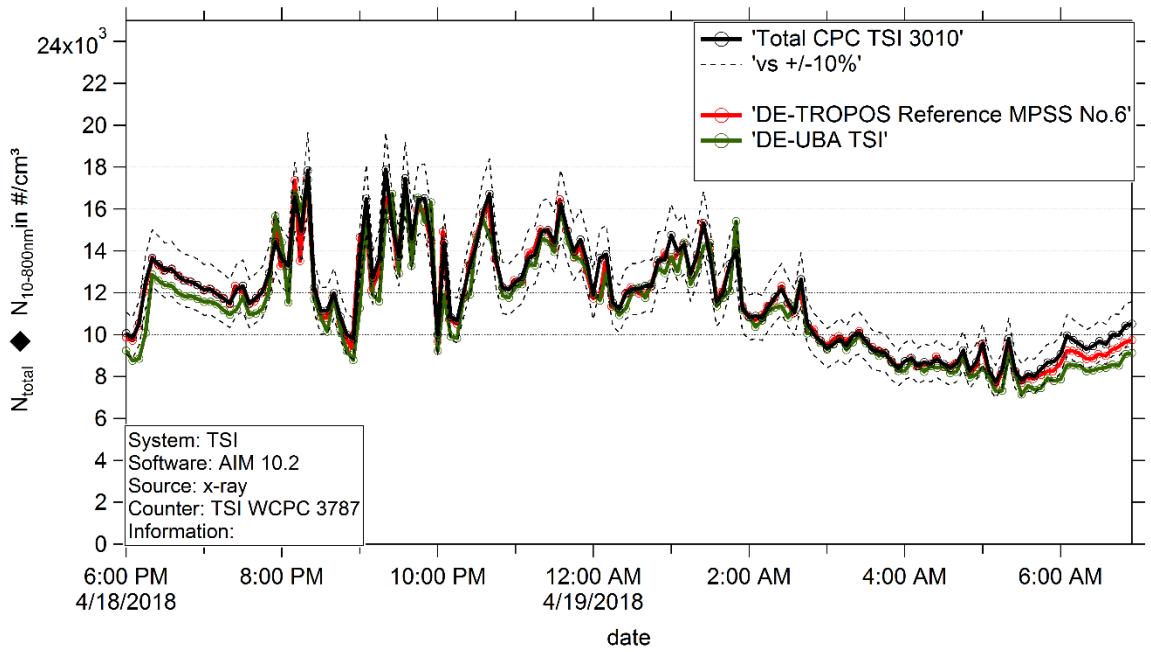

Figure 12: Time series (April 18, 2018 08:00 PM – April 19, 2018 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion and correction for the candidate was performed using TROPOS software.

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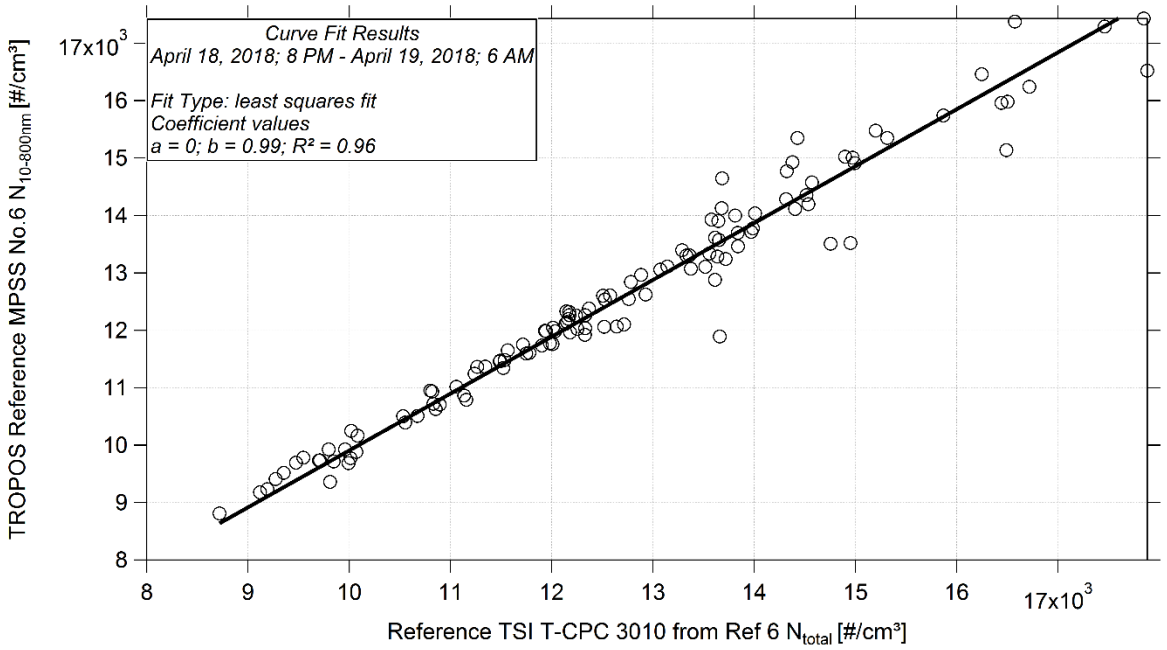

Figure 13: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and TROPOS Reference MPSS Ref 6 (April 18, 2018 08:00 PM – April 19, 2018 06:00 AM). All corrections are included.

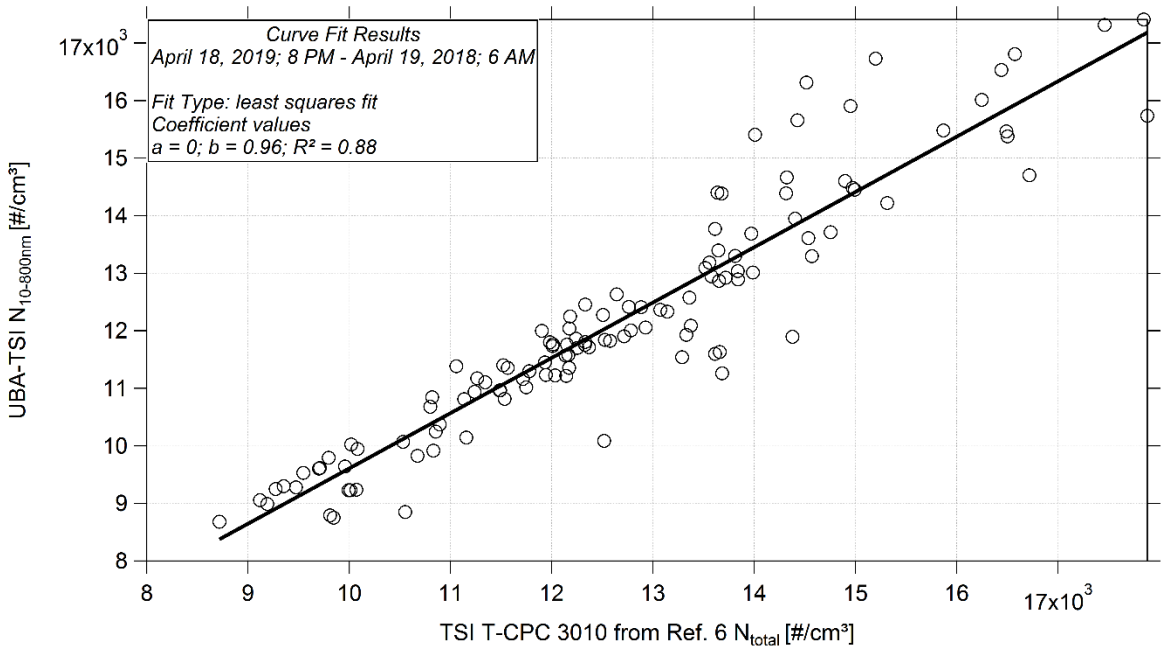

Figure 14: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and UBA-TSI (April 18, 2018 08:00 PM – April 19, 2018 06:00 AM). All corrections are included.

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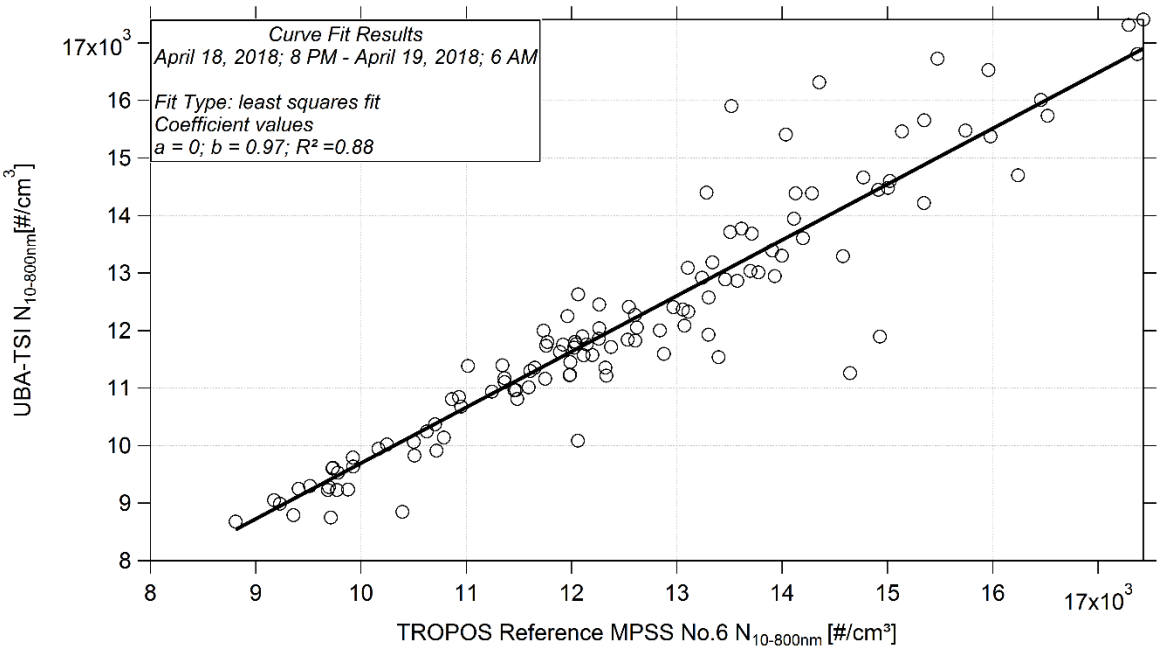

Figure 15: Linear regression between the number concentrations of the TROPOS Reference MPSS Ref 6 and UBA-TSI (April 18, 2018 08:00 PM – April 19, 2018 06:00 AM). All corrections are included.

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