

Intercomparison of Mobility Particle Size Spectrometers

Project No.: Online

MPSS-2019-2-6

Principal Investigator:

Andreas Schwerin

Home Institution:

Umweltbundesamt

Participant: -

*Candidate: MPSS Waldhof
Made by: TROPOS Homemade
Counter (SN): 3772164503*

Location of the quality assurance:

TROPOS Leipzig, lab 118

Comparison period:

May 20, 2019 – May 29, 2019

Last Intercomparison (with Project No.):

Summary of Intercomparison:

Pre-Status:

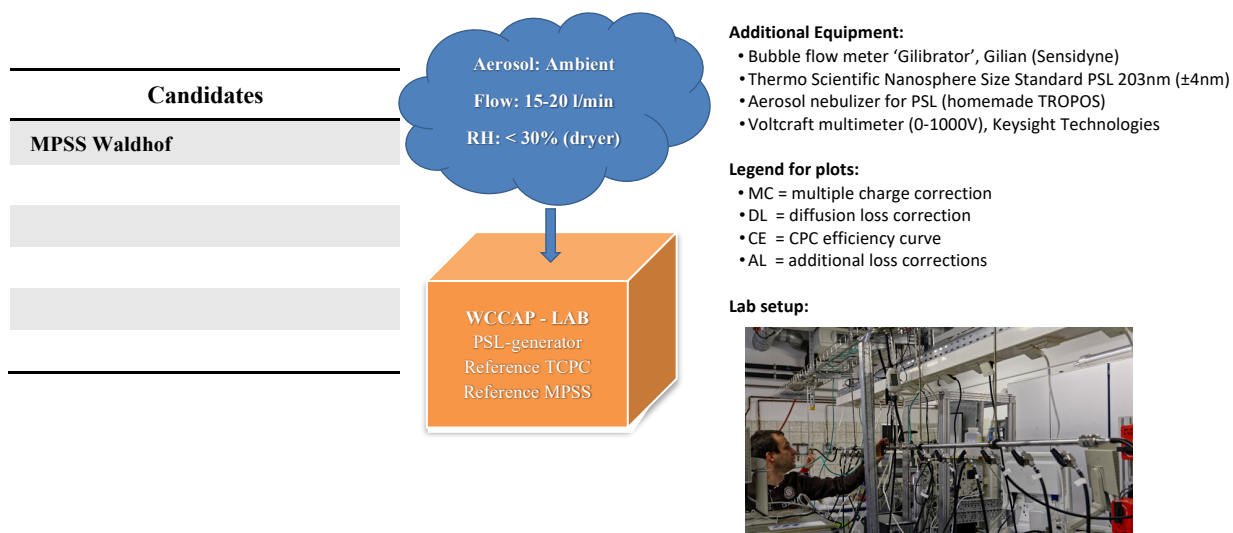
The candidate from UBA-Waldhof MPSS participated in the ACTRIS workshop from May 20, 2019 to May 29, 2019 with the participant. The setup of the candidate was done on Monday, May 20th, afternoon. During the Pre-Status the candidate was running under the same settings, with their own TSI Kr.85 source, like on the Institute. The performance of the candidate showed a concentration 12% lower than the TROPOS Reference Instrument No.1. On Tuesday, May 21th, after the CPC-Workshop the MPSS was checked. The performance of the CPC is shown in the Report of the CPC-Workshop. The TSI CPC 3772 passed the CPC Workshop. For more information, please look at the CPC-workshop report. During the workshop week, the whole candidate was and the DMA was too low and had to be changed. More details are in the Tables for each night run.

- Nafion dryer in the aerosol inlet wasn't performing well
- DMA was too low and had to be changed

Final-Status:

The final run took place from May 28 to May 29, 2019. Running the candidate using the original source Kr.85 and the TROPOS Reference CPC No.1 the performance showed a concentration 3% lower than the TROPOS Reference Instrument No.1. The original DMA from UBA-Waldhof MPSS had to be changed. And the Aerosol inlet nafion dryer wasn't performing properly. The candidate passed the standards of ACTRIS and GAW under the conditions, using the TROPOS Reference CPC No.1.

Laboratory Setup and Legend



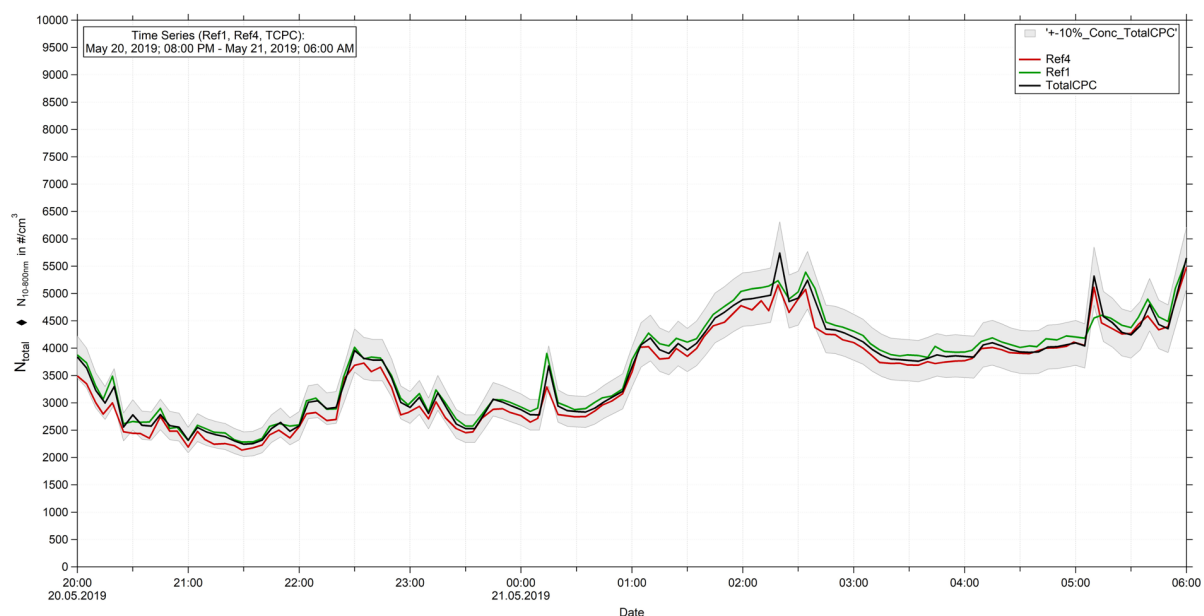
TROPOS Reference Instruments No. 1 and No. 4**May 20 – May 21, 2019: Time Series, Particle Number Size Distribution and Correlation**

Figure 01: Time series (May 20, 2019 8 PM – May 21, 2019 6 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the TROPOS Reference MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

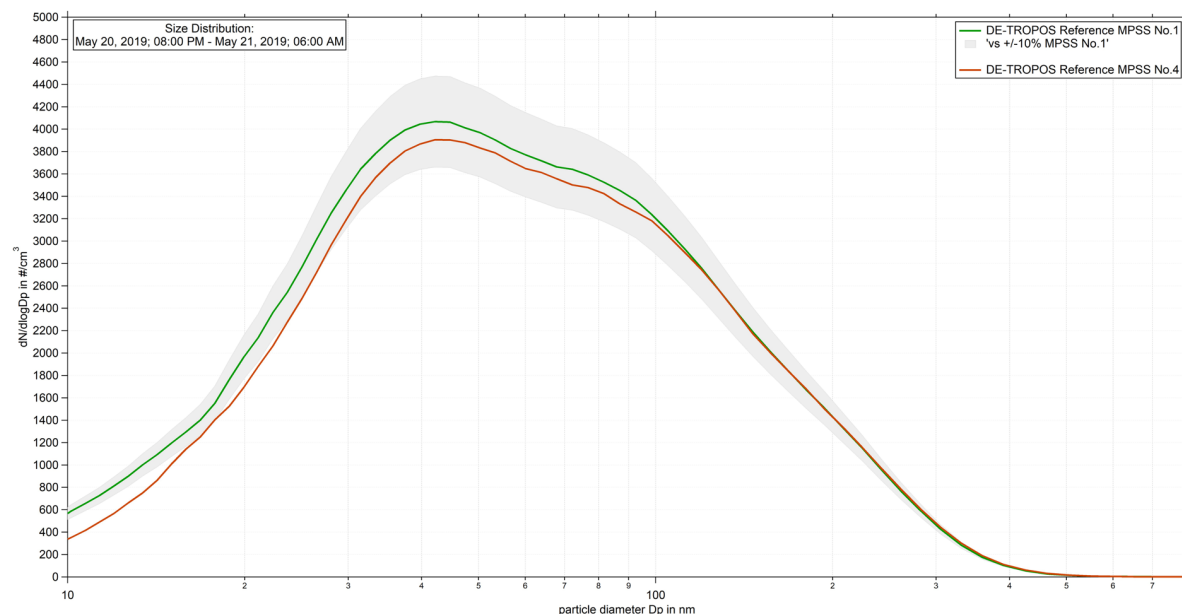


Figure 02: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against TROPOS Reference MPSS No.4 from May 20, 2019 8 PM – May 21, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

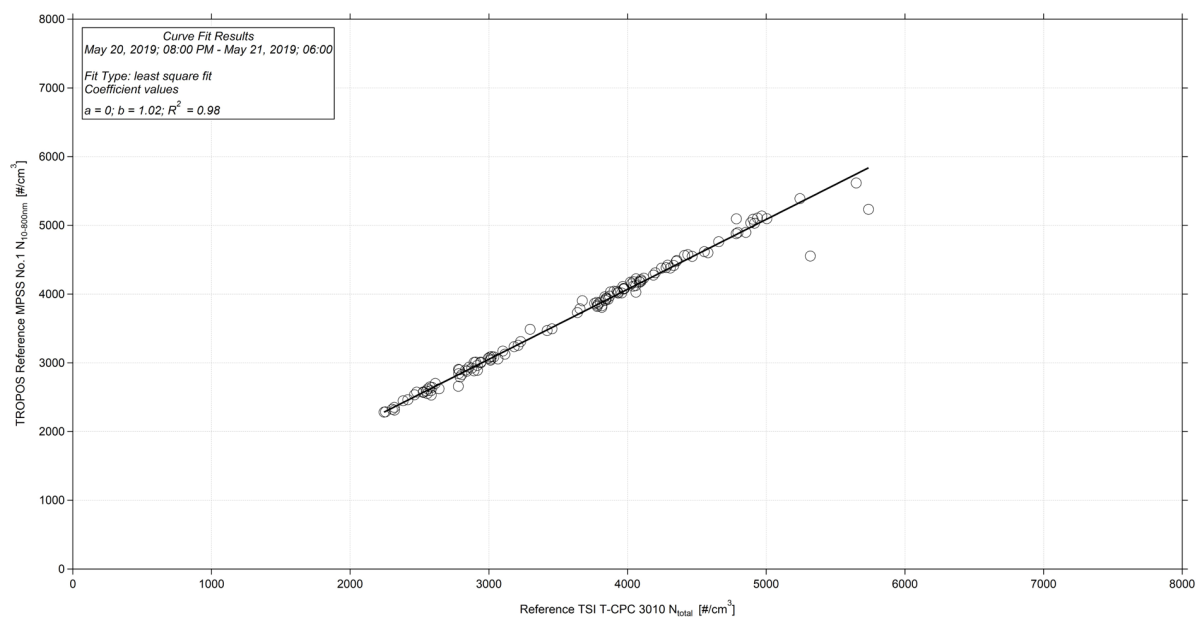


Figure 03: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

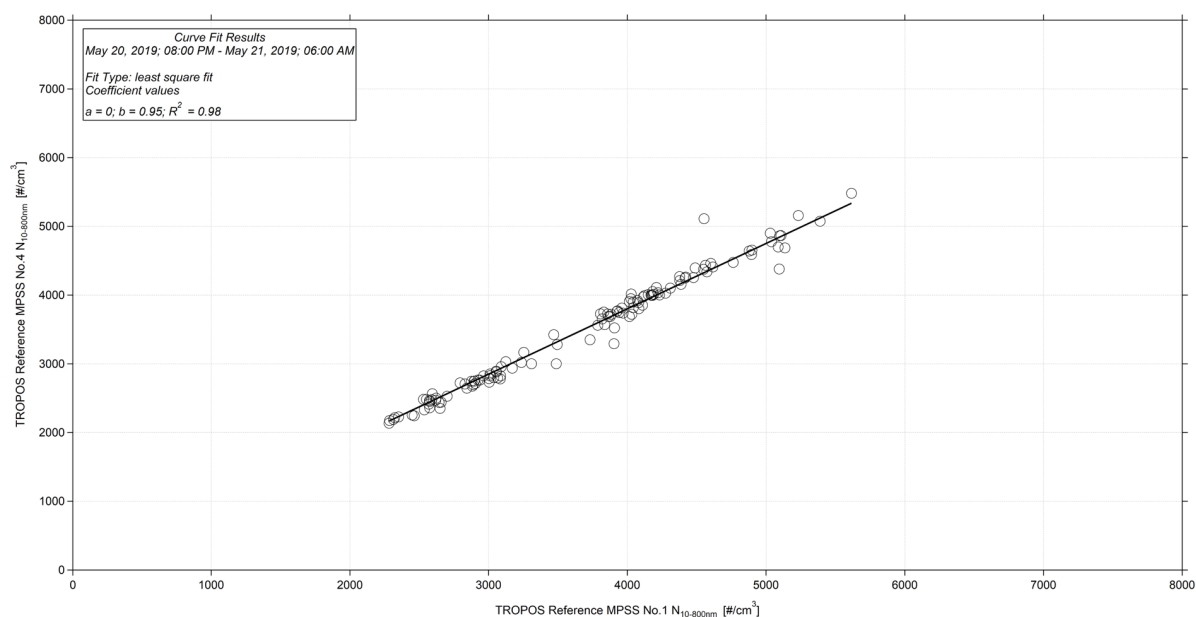


Figure 04: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

PSL Scan: Latex 203 nm +/- 4 nm

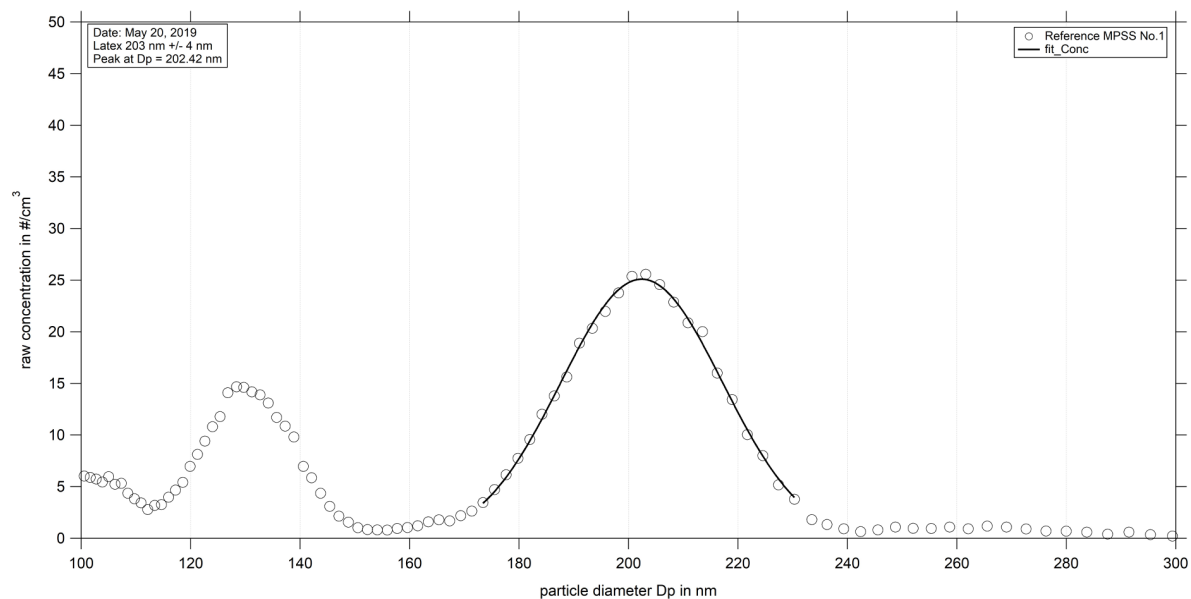


Figure 05: Measurement of latex 203 nm - Reference MPSS No.1: Particle size distribution (raw concentration) for latex 203 nm on May 20th 2019.

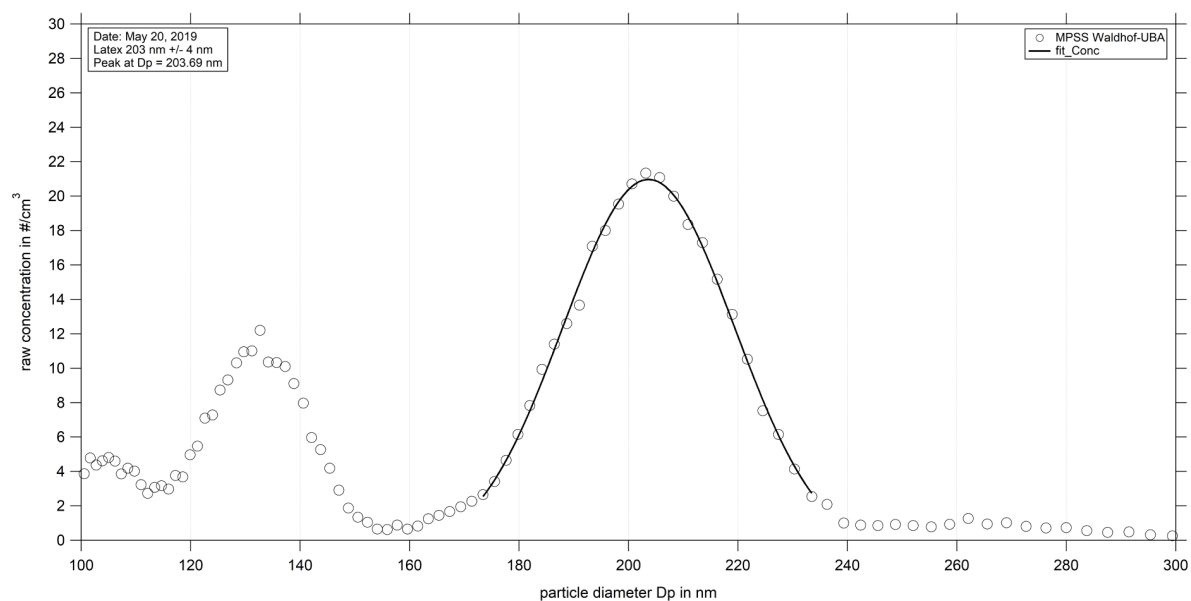


Figure 06: Measurement of latex 203 nm for the candidate UBA-Waldhof MPSS: Particle size distribution for latex 203 nm on October 15th 2018 with a peak at 203.69 nm.

Pre-Status May 20 – 21, 2019**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 1:

Institute: Umweltbundesamt							
Station: Waldhof							
Date of checking list: 20.05.2019							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS			ST	39.0	OFF	
Firmware Classifier:	TROPOS			CT	22.0	5 V	5.5
Firmware Software:	6.68			OT	40.0	1000 V	999.2
DMA type:	Vienna		177	CabT	34.6	0 V	0
CPC model:	TSI CPC 3772-CEN	3772164503		AP	98.5		
Firmware CPC:	6.0			OP	67.1	5 V	5.5
radioactive source:	Kr.85	77A-0722		NP	0.4	1000 V	999.7
Aerosol Nafion Dryer		MD-110-12E-S 072717-17-09				250 V	250.0
Sheath Nafion Dryer		ND0.7-187E				5 V	5.5
Aerosol inlet dryer		ND0.7-206				0	0
Flow CPC (l/min):				LC	42		
Flow Inlet (l/min):	0.9761						
Flow Display (l/min):							
Zero (#/cm ³):							
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:							
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:							
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:							
Impactor:							
Setup settings over night:							

Institute: TROPOS							
Station: Reference Instrument No.1							
Date of checking list: May 20, 2019							
Instrument/ Components	info	Serial Number	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS	No.1		ST	39.0	0 V	0
Firmware Classifier:				CT	22.0	5 mV	5.1
Firmware Software:	TROPOS 6.68			OT	40.0	800 mV	999.7
DMA type:	Hauke medium		142	CabT	27.3	200 mV	249.8
CPC model:	TSI 3772	3772141701		AP	98.5	0 V	0
Firmware CPC:	2.15			OP	72.1		
Radioactive source:	Kr.85	NER 8275	002/13	NP	2.8		
Flow Inlet (l/min):	1.009			LC	50		
Zero (#/cm ³):	0						

Institute: TROPOS					
Station: Reference Total CPC					
Date of checking list: May 20, 2019					
Instrument/ Components	info	Serial Number	Cut off	CPC-Status	
CPC model:	TSI 3010	2337	D _{p50} 10 nm	ST	
Firmware CPC:	2.15			CT	
Flow Inlet (l/min):	1.001			OT	
Zero (#/cm ³):	0			CabT	
				AP	
				OP	
				NP	
				LC	

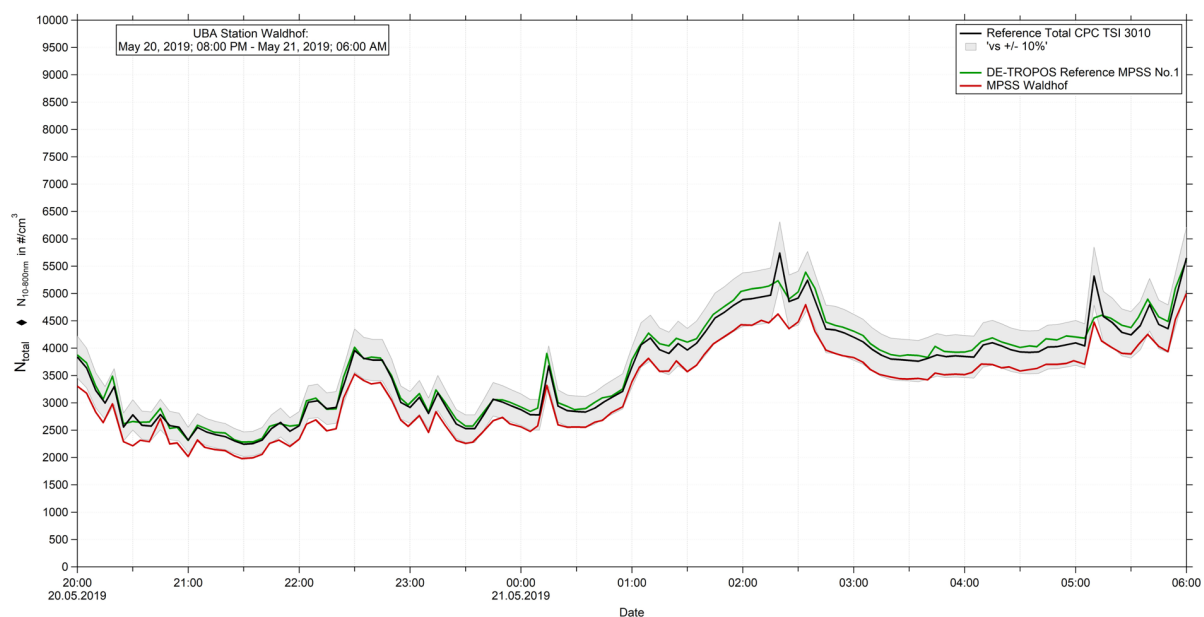


Figure 08: Time series (May 20, 2019 8 PM – May 21, 2019 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included. The candidate is running with the Kr.85 source.

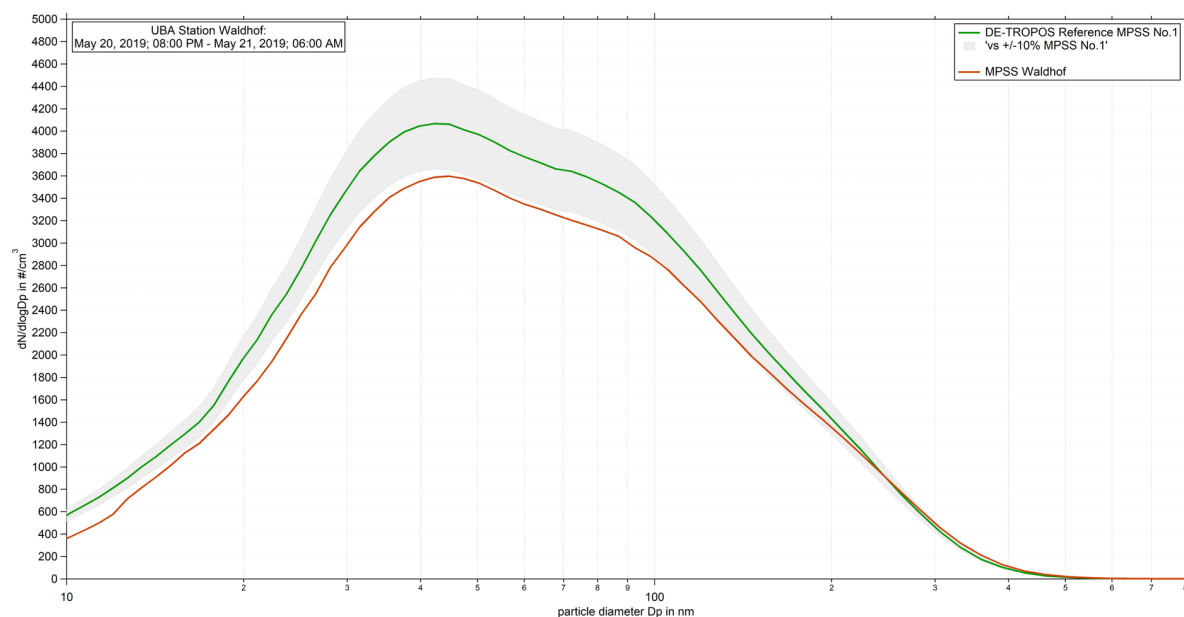


Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Waldhof MPSS from May 20, 2019 8 PM – May 21, 2019 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

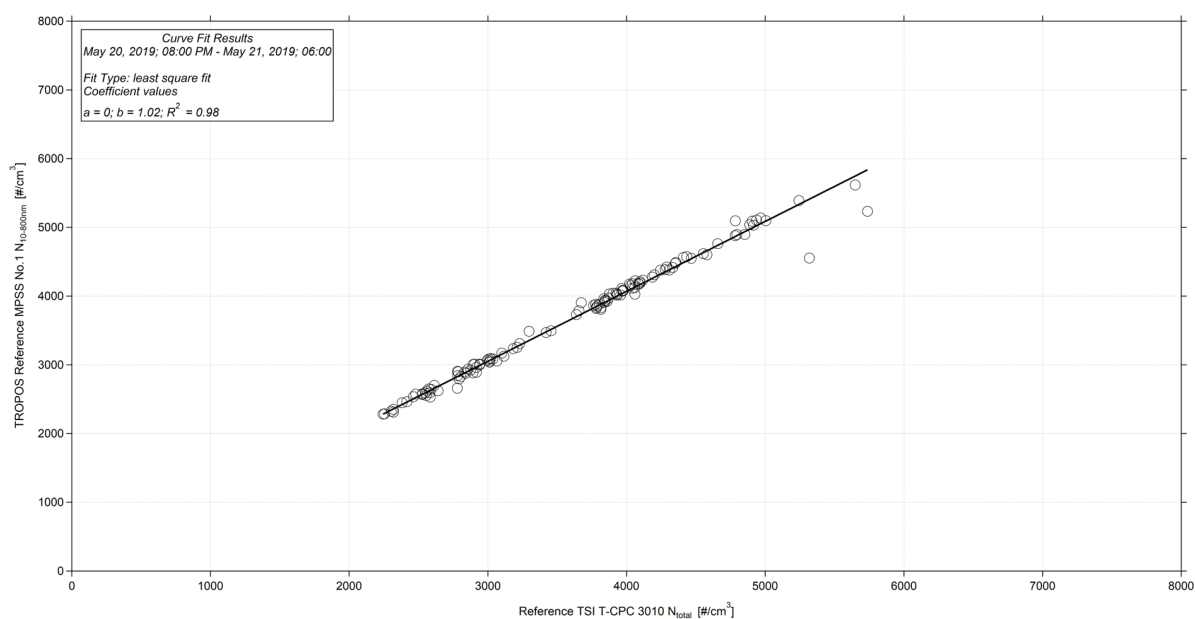


Figure 10: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

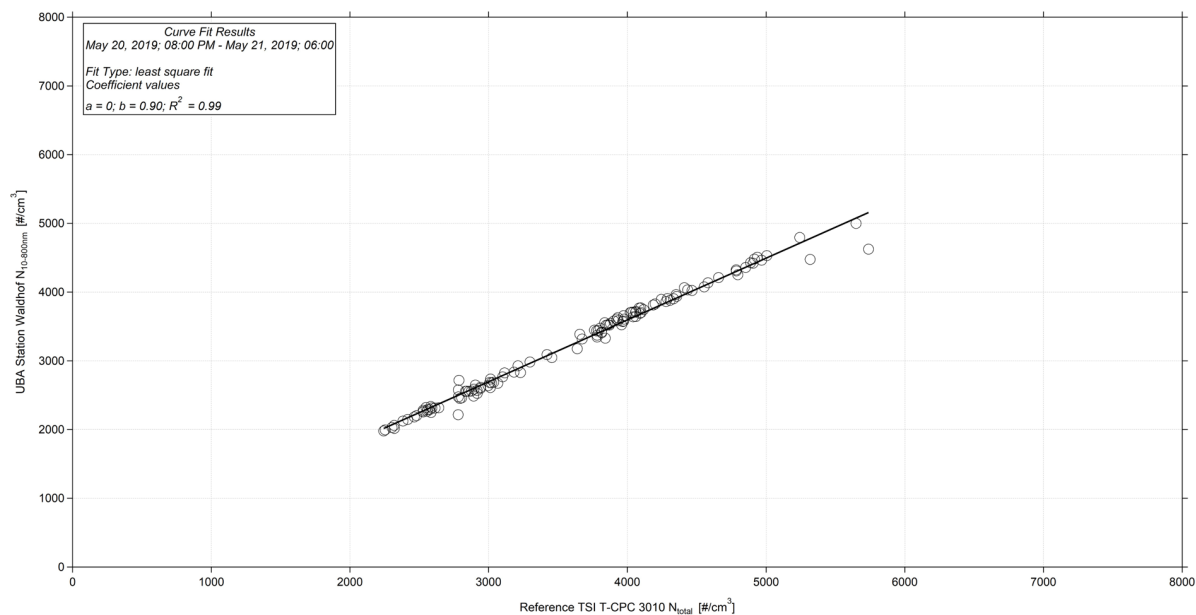


Figure 11: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and UBA-Waldhof MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

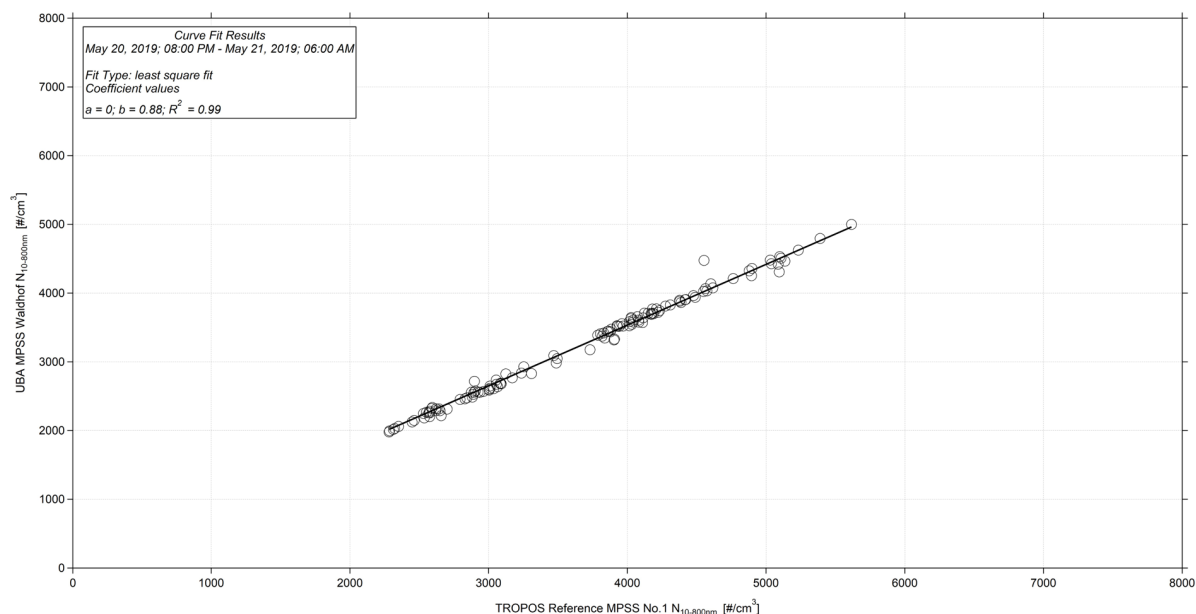


Figure 12: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Waldhof MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status May 21 – 22, 2019**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 2:

Institute: Umweltbundesamt							
Station: Waldhof							
Date of checking list: 21.05.2019							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS			ST	39.0	OFF	
Firmware Classifier:	TROPOS			CT	22.0	5 V	5.5
Firmware Software:	6.68			OT	40.0	1000 V	999.2
DMA type:	Vienna		177	CabT	34.6	0 V	0
CPC model:	TSI CPC 3772-CEN	3772164503		AP	98.5		
Firmware CPC:	6.0			OP	67.1	5 V	5.5
radioactive source:	Kr.85	77A-0722		NP	0.4	1000 V	999.7
Aerosol Nafion Dryer		MD-110-12E-S 072717-17-09				250 V	250.0
Sheath Nafion Dryer		ND0.7-187E				5 V	5.5
Aerosol inlet dryer		ND0.7-206				0	0
Flow CPC (l/min):				LC	42		
Flow Inlet (l/min):	0.9761						
Flow Display (l/min):							
Zero (#/cm ³):							
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:	Instrument is running without nafion from 21.-22.05.19. Nafion -> check						
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:							
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:							
Impactor:							
Setup settings over night:							

Institute: TROPOS							
Station: Reference Instrument No.1							
Date of checking list: May 21, 2019							
Instrument/ Components	info	Serial Number	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS	No.1		ST	39.0	0 V	0
Firmware Classifier:				CT	22.0	5 mV	5.1
Firmware Software:	TROPOS 6.68			OT	40.0	800 mV	999.7
DMA type:	Hauke medium		142	CabT	27.3	200 mV	249.8
CPC model:	TSI 3772	3772141701		AP	98.5	0 V	0
Firmware CPC:	2.15			OP	72.1		
Radioactive source:	Kr.85	NER 8275	002/13	NP	2.8		
Flow Inlet (l/min):	1.009			LC	50		
Zero (#/cm ³):	0						

Institute: TROPOS					
Station: Reference Total CPC					
Date of checking list: May 21, 2019					
Instrument/ Components	info	Serial Number	Cut off	CPC-Status	
CPC model:	TSI 3010	2337	D_{p50} 10 nm	ST	
Firmware CPC:	2.15			CT	
Flow Inlet (l/min):	1.001			OT	
Zero (#/cm ³):	0			CabT	
				AP	
				OP	
				NP	
				LC	

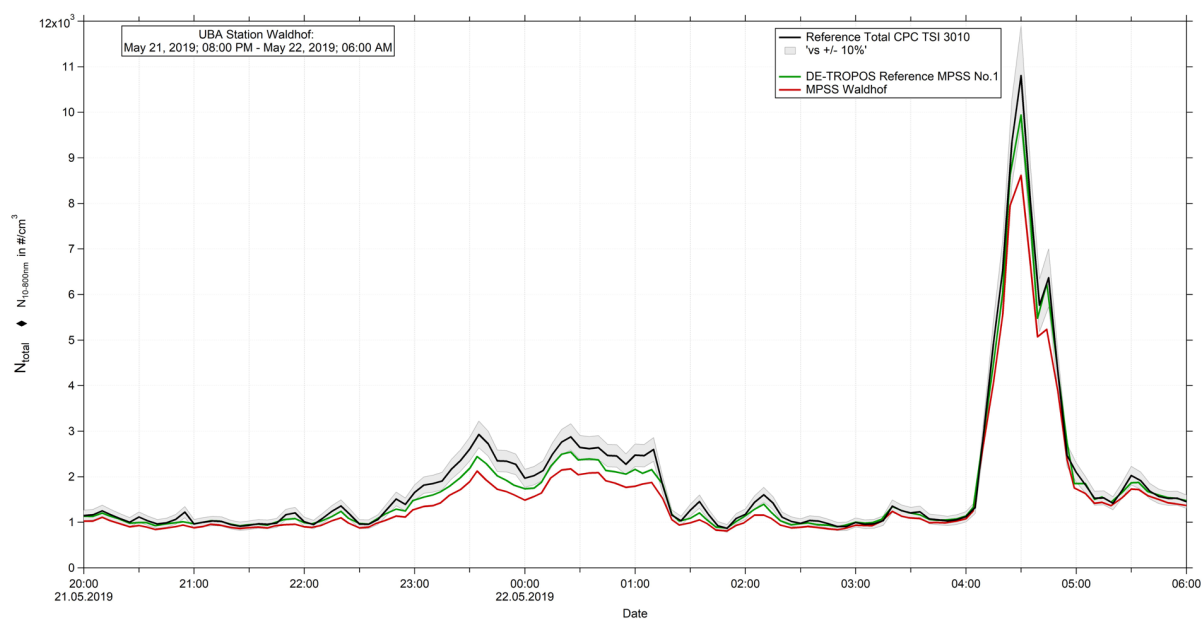


Figure 13: Time series (May 21, 2019 8 PM – May 22, 2019 6 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

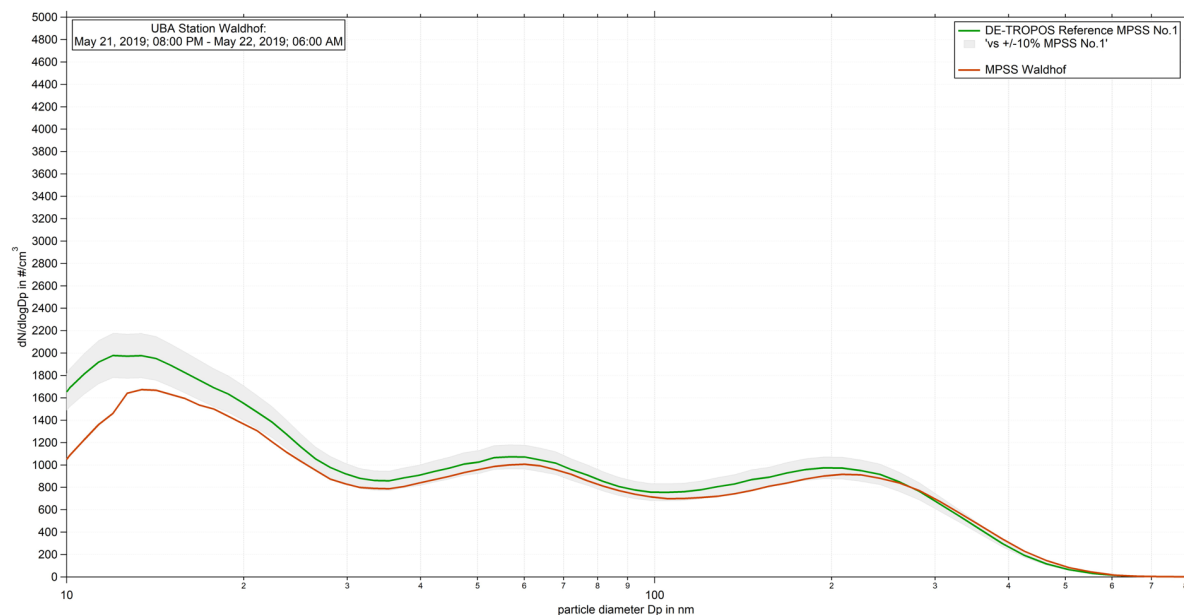


Figure 14: Comparison of median particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Waldhof MPSS from May 21, 2019 8 PM – May 22, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

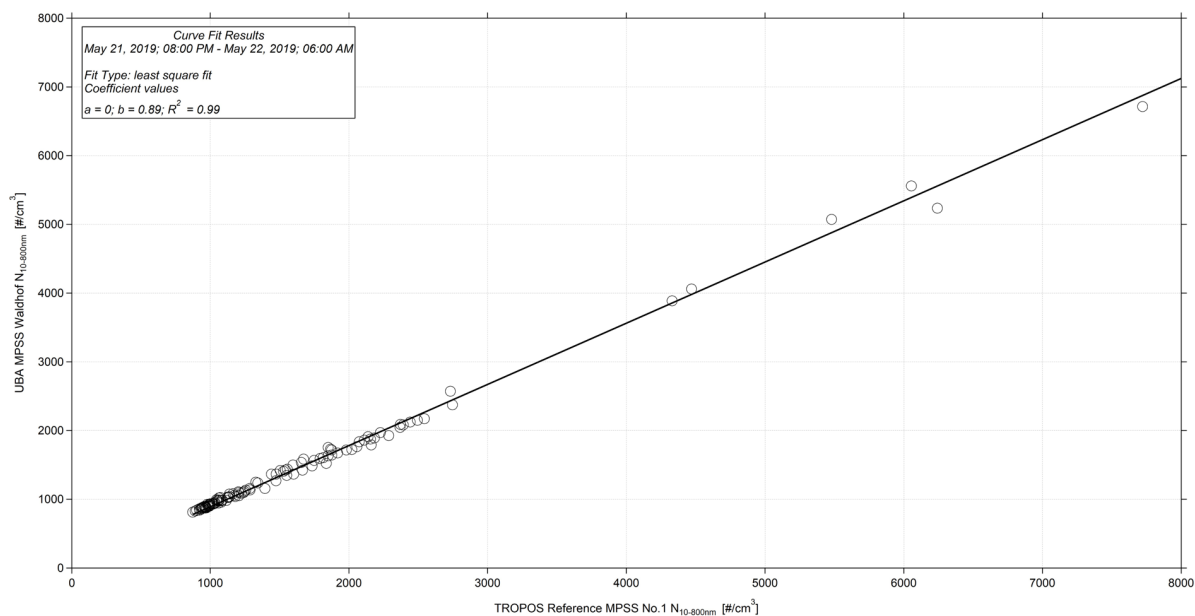


Figure 15: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Waldhof MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status May 22 – 23, 2019**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 2:

Institute: Umweltbundesamt							
Station: Waldhof							
Date of checking list: 22.05.2019							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS			ST	39.0	OFF	
Firmware Classifier:	TROPOS			CT	22.0	5 V	5.0
Firmware Software:	6.68			OT	40.0	1000 V	999.7
DMA type:	Vienna		177	CabT	34.6	0 V	0
CPC model:	TSI CPC 3772-CEN	3772164503		AP	98.5		
Firmware CPC:	6.0			OP	67.1	5 V	5.0
radioactive source:	Kr.85	77A-0722		NP	0.4	1000 V	1009.1
Aerosol Nafion Dryer		MD-110-12E-S 072717-17-09				250 V	249.8
Sheath Nafion Dryer		ND0.7-187E				5 V	5.0
Aerosol inlet dryer		ND0.7-206				0	0.1
Flow CPC (l/min):				LC	42		
Flow Inlet (l/min):	0.987						
Flow Display (l/min):							
Zero (#/cm ³):							
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:	Instrument is running without nafion from 22.-23.05.19						
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:							
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:	CPC change SN 70835060						
Impactor:							
Setup settings over night:							

Institute: TROPOS							
Station: Reference Instrument No.1							
Date of checking list: May 22, 2019							
Instrument/ Components	info	Serial Number	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS	No.1		ST		0 V	0.3
Firmware Classifier:				CT		4 mV	4.9
Firmware Software:	TROPOS 6.68			OT		800 mV	999.9
DMA type:	Hauke medium		142	CabT		200 mV	249.8
CPC model:	TSI 3772	3772141701		AP		0 V	0.3
Firmware CPC:	2.15			OP			
Radioactive source:	Kr.85	NER 8275	002/13	NP			
Flow Inlet (l/min):	1.012			LC			
Zero (#/cm ³):	0						

Institute: TROPOS					
Station: Reference Total CPC					
Date of checking list: May 22, 2019					
Instrument/ Components	info	Serial Number	Cut off	CPC-Status	
CPC model:	TSI 3010	2337	D_{p50} 10 nm	ST	
Firmware CPC:	2.15			CT	
Flow Inlet (l/min):	1.008			OT	
Zero (#/cm ³):	0			CabT	
				AP	
				OP	
				NP	
				LC	

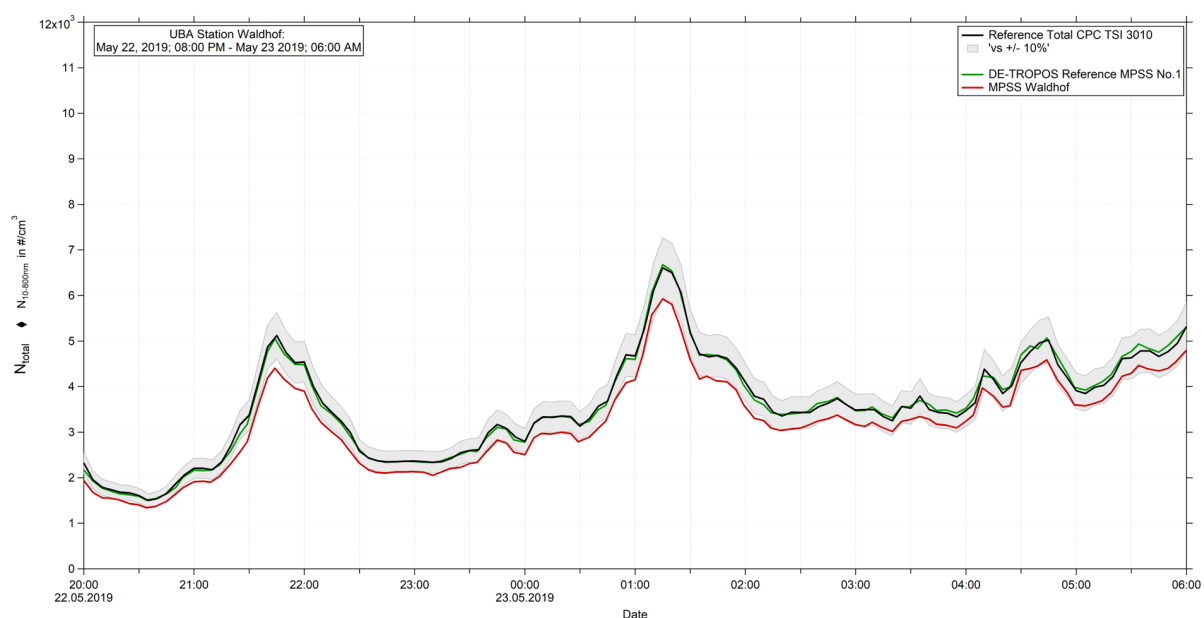


Figure 16: Time series (May 22, 2019 8 PM – May 23, 2019 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

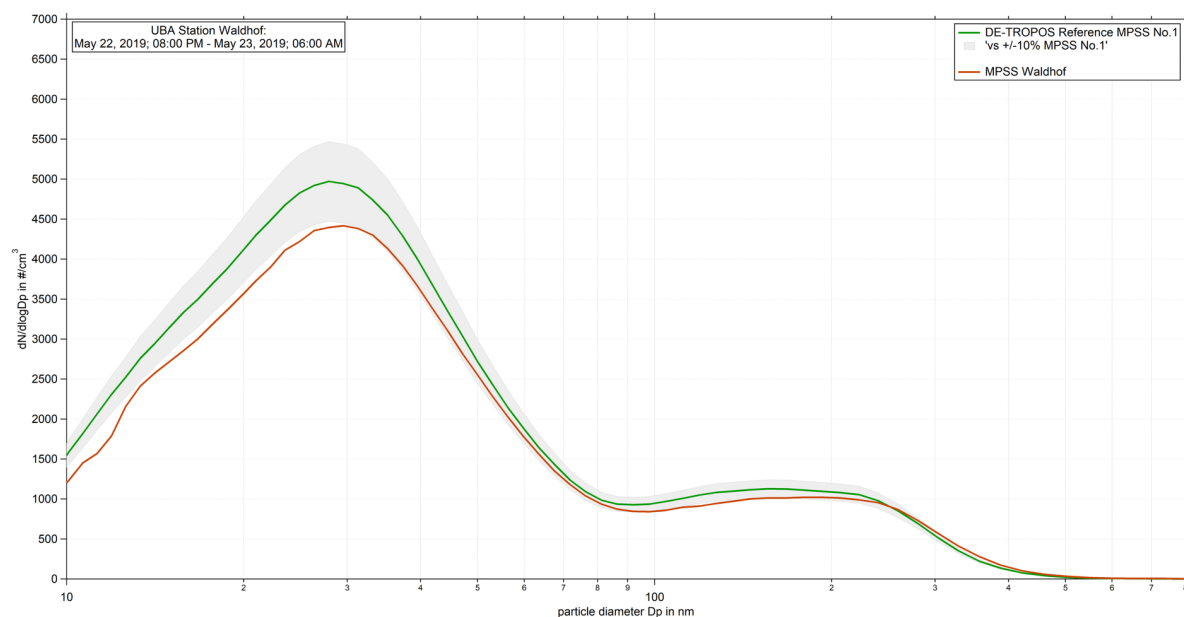


Figure 17: Comparison of median particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Waldhof MPSS from May 22, 2019 8 PM – May 23, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

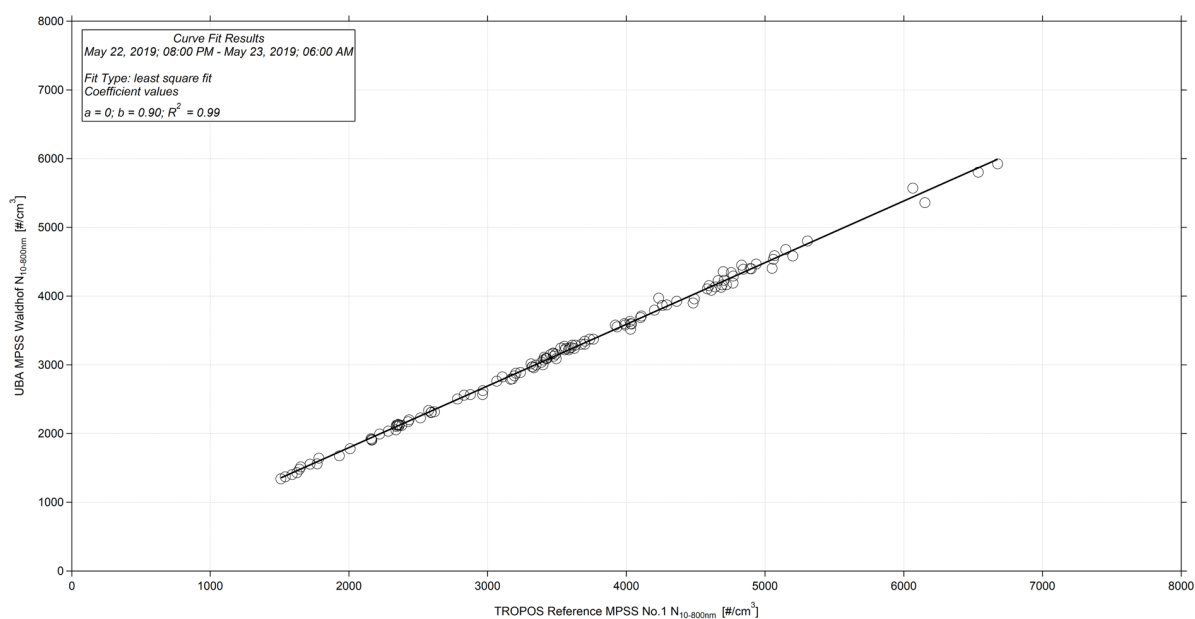


Figure 18: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Waldhof MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status May 23 – 24, 2019**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 3:

<i>Institute: Umweltbundesamt</i>							
<i>Station: Waldhof</i>							
<i>Date of checking list: 23.05.2019</i>							
<i>Instrument/ Components</i>	<i>info</i>	<i>SN</i>	<i>Date/Code</i>	<i>CPC-Status</i>		<i>HV-Status</i>	
<i>MPSS/Classifier:</i>	TROPOS			<i>ST</i>	39.0	<i>OFF</i>	
<i>Firmware Classifier:</i>	TROPOS			<i>CT</i>	22.0	<i>5 V</i>	
<i>Firmware Software:</i>	6.68			<i>OT</i>	40.0	<i>10 V</i>	
<i>DMA type:</i>	Vienna		177	<i>CabT</i>	34.6	<i>1000 V</i>	
<i>CPC model:</i>	TSI CPC 3772-CEN			<i>AP</i>	98.5	<i>250 V</i>	
<i>Firmware CPC:</i>	6.0			<i>OP</i>	67.1	<i>5 V</i>	
<i>radioactive source:</i>	Kr.85	77A-0722		<i>NP</i>	0.4	<i>400 V</i>	
<i>Aerosol Nafion Dryer</i>		MD-110-12E-S 072717-17-09					
<i>Sheath Nafion Dryer</i>		ND0.7-187E					
<i>Aerosol inlet dryer</i>		ND0.7-206					
<i>Flow CPC (l/min):</i>				<i>LC</i>	42	<i>600 V</i>	
<i>Flow Inlet (l/min):</i>	0.987					<i>800 V</i>	
<i>Flow Display (l/min):</i>						<i>700 V</i>	
<i>Zero (#/cm³):</i>						<i>650 V</i>	
<i>Maintenance</i>							
<i>Aerosol inlet:</i>							
<i>Aerosol Nafion dryer:</i>	System running with nafion						
<i>Sheath Nafion dryer:</i>							
<i>Source:</i>							
<i>HV power supply:</i>							
<i>DMA:</i>	DMA changed from 177 to 167						
<i>Aerosol/sheath RH/T- sensor:</i>							
<i>Pressure sensor:</i>							
<i>Filter:</i>							
<i>NI-card:</i>							
<i>CPC:</i>	CPC Switched back to MPSS CPC instead of TCPC						
<i>Impactor:</i>							
<i>Setup settings over night:</i>							

<i>Institute: TROPOS</i>							
<i>Station: Reference Instrument No.1</i>							
<i>Date of checking list: 23.05.2019</i>							
<i>Instrument/ Components</i>	<i>info</i>	<i>Serial Number</i>	<i>Date/Code</i>	<i>CPC-Status</i>		<i>HV-Status</i>	
<i>MPSS/Classifier:</i>	TROPOS	No.1		<i>ST</i>		<i>0 V</i>	
<i>Firmware Classifier:</i>				<i>CT</i>		<i>5 mV</i>	
<i>Firmware Software:</i>	TROPOS 6.68			<i>OT</i>		<i>800 mV</i>	
<i>DMA type:</i>	Hauke medium		142	<i>CabT</i>		<i>200 mV</i>	
<i>CPC model:</i>	TSI 3772	3772141701		<i>AP</i>		<i>0 V</i>	
<i>Firmware CPC:</i>	2.15			<i>OP</i>			
<i>Radioactive source:</i>	Kr.85	NER 8275	002/13	<i>NP</i>			
<i>Flow Inlet (l/min):</i>	1.02			<i>LC</i>			
<i>Zero (#/cm³):</i>	0						

Institute: TROPOS					
Station: Reference Total CPC					
Date of checking list: October 18, 2019					
Instrument/ Components	info	Serial Number	Cut off	CPC-Status	
CPC model:	TSI 3010	2410	D_{p50} 10 nm	ST	
Firmware CPC:	2.15			CT	
Flow Inlet (l/min):	1.01			OT	
Zero (#/cm ³):	0			CabT	
				AP	
				OP	
				NP	
				LC	

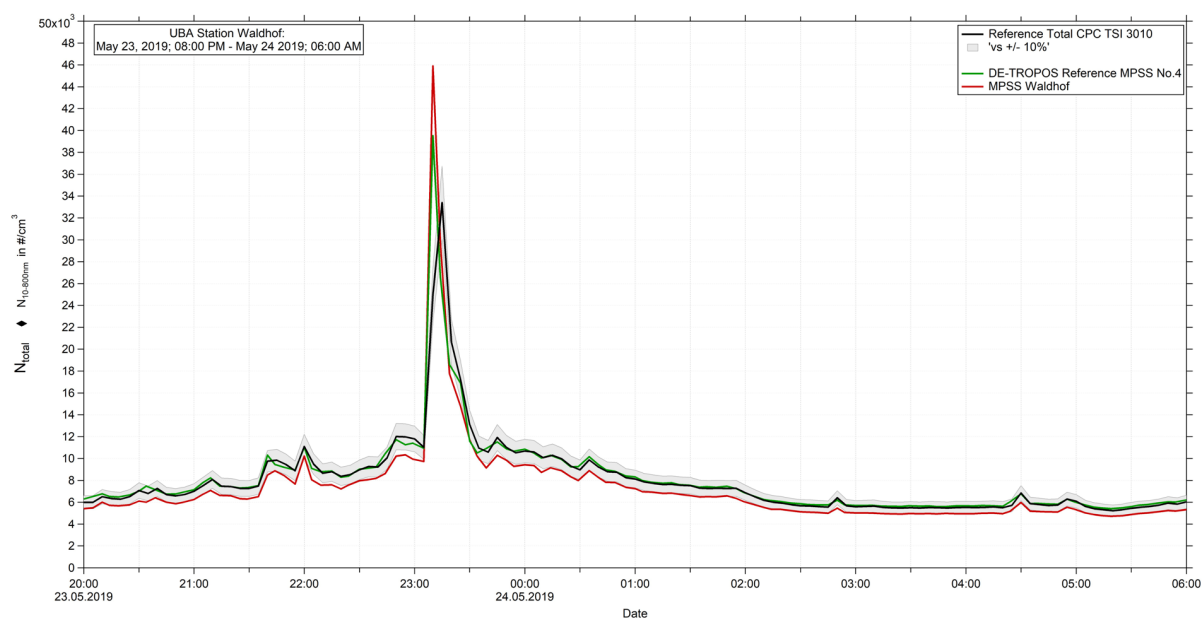


Figure 19: Time series (May 23, 2019 8 PM – May 24, 2019 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

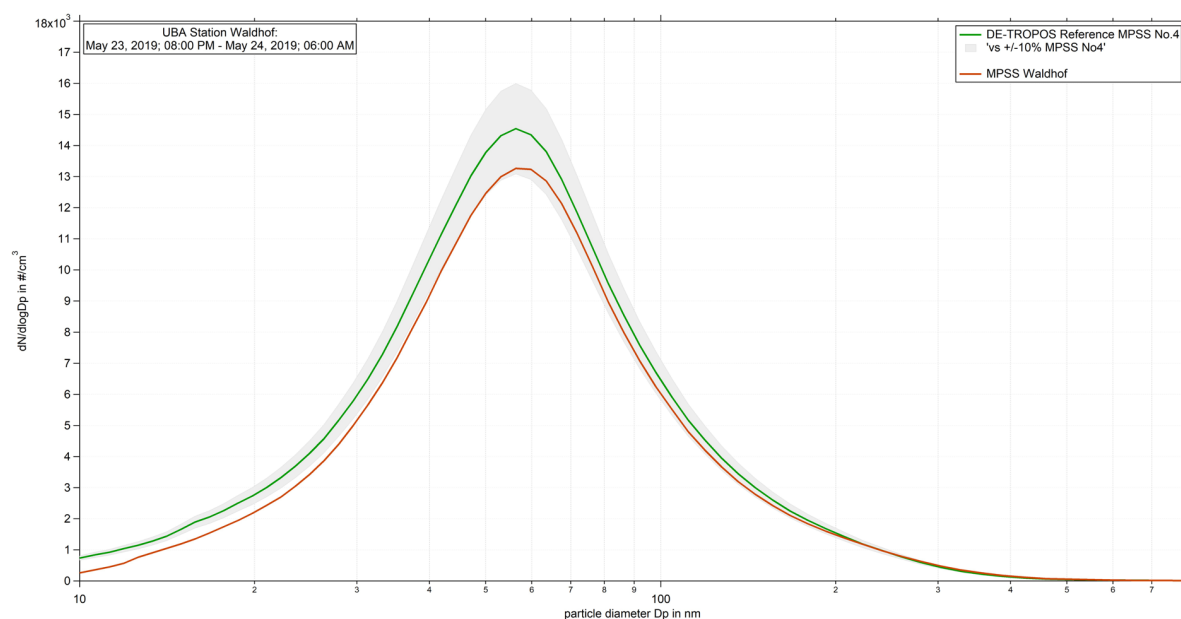


Figure 20: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against UBA-Waldhof MPSS from May 23, 2019 8 PM – May 24, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

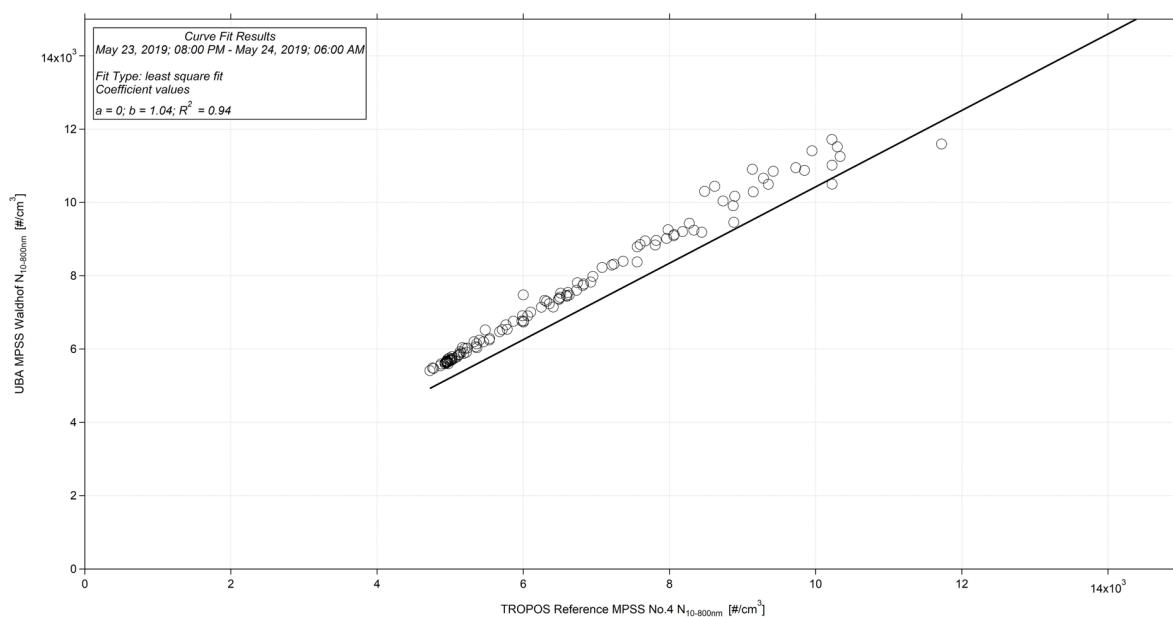


Figure 21: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and UBA-Waldhof. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status May 24 – 27, 2019**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 4:

Institute: Umweltbundesamt							
Station: Waldhof							
Date of checking list: 24.05.2019							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS			ST	39.0	OFF	
Firmware Classifier:	TROPOS			CT	22.0	5 V	
Firmware Software:	6.68			OT	40.0	10 V	
DMA type:	Vienna		177	CabT	34.6	1000 V	
CPC model:	TSI CPC 3772-CEN			AP	98.5	250 V	
Firmware CPC:	6.0			OP	67.1	5 V	
radioactive source:	Kr.85	77A-0722		NP	0.4	400 V	
Aerosol Nafion Dryer		MD-110-12E-S 072717-17-09					
Sheath Nafion Dryer		ND0.7-187E					
Aerosol inlet dryer		ND0.7-206					
Flow CPC (l/min):				LC	42	600 V	
Flow Inlet (l/min):	0.987					800 V	
Flow Display (l/min):						700 V	
Zero (#/cm ³):						650 V	
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:	System running with nafion						
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:							
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:							
Impactor:							
Setup settings over night:							
	Capillary Cleaned -Aerosol flow directly running through The radioactive source						

Institute: TROPOS							
Station: Reference Instrument No.1							
Date of checking list: 24.05.2019							
Instrument/ Components	info	Serial Number	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS	No.1		ST		0 V	
Firmware Classifier:				CT		5 mV	
Firmware Software:	TROPOS 6.68			OT		800 mV	
DMA type:	Hauke medium		142	CabT		200 mV	
CPC model:	TSI 3772	3772141701		AP		0 V	
Firmware CPC:	2.15			OP			
Radioactive source:	Kr.85	NER 8275	002/13	NP			
Flow Inlet (l/min):	1.02			LC			
Zero (#/cm ³):	0						

Institute: TROPOS					
Station: Reference Total CPC					
Date of checking list: 24.05.2019					
Instrument/ Components	info	Serial Number	Cut off	CPC-Status	
CPC model:	TSI 3010	2410	D _{p50} 10 nm	ST	
Firmware CPC:	2.15			CT	
Flow Inlet (l/min):	1.01			OT	
Zero (#/cm ³):	0			CabT	
				AP	
				OP	
				NP	
				LC	

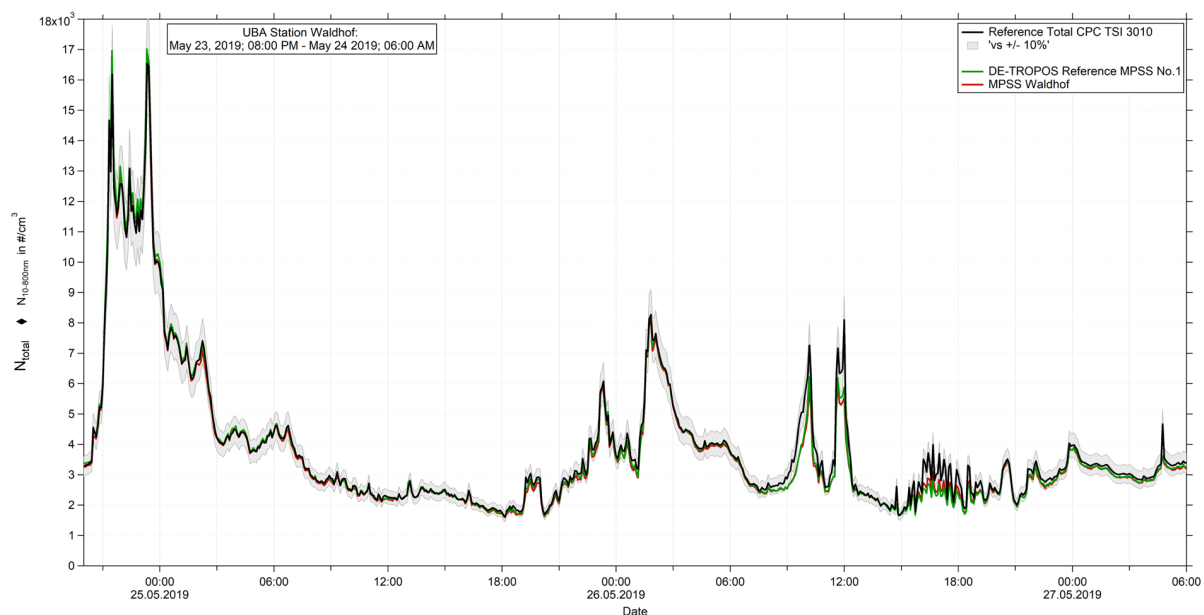


Figure 22: Time series (May 24, 2019 8 PM – May 27, 2019 6 AM) of the integrated particle number concentration ($N_{10.800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

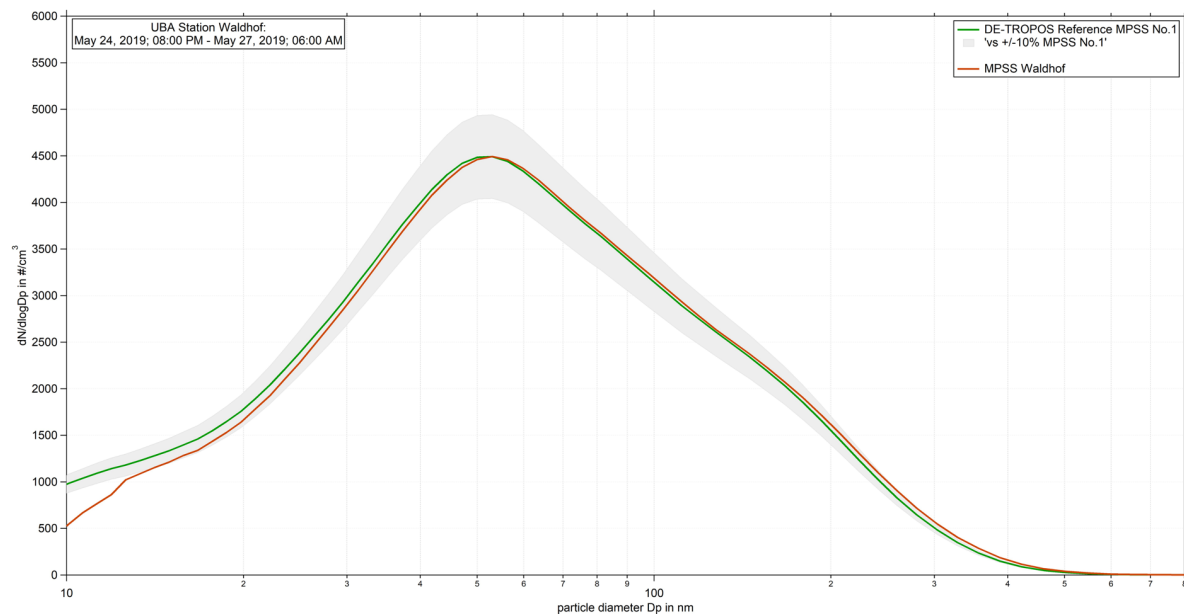


Figure 23: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against UBA-Waldhof MPSS from May 23, 2019 8 PM – May 24, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

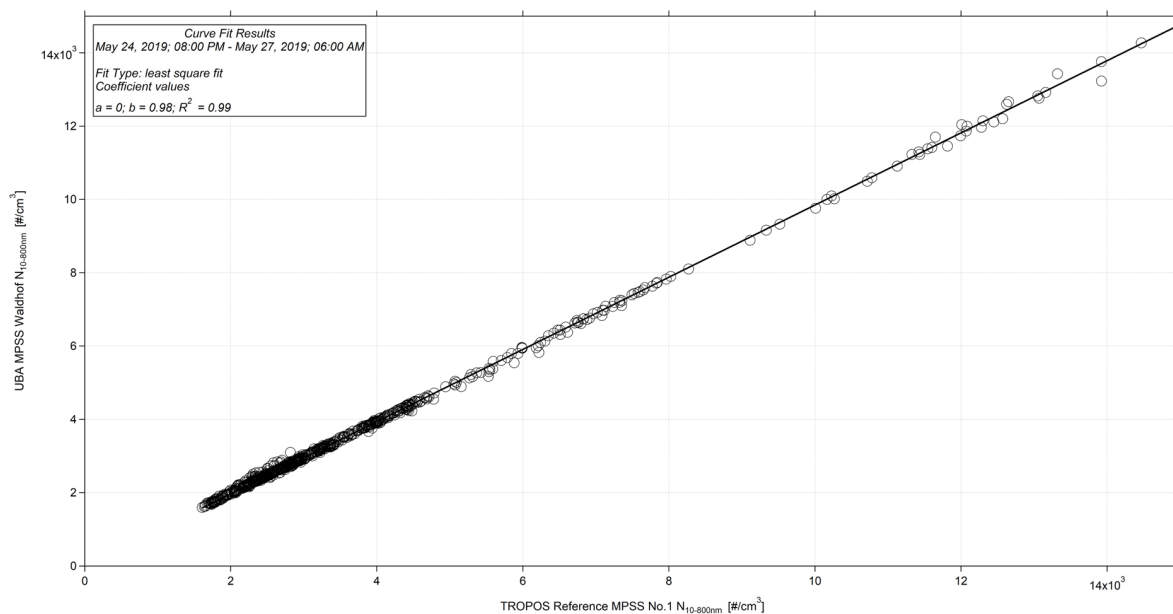


Figure 24: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Waldhof. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status May 27 – 28, 2019**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 4:

Institute: Umweltbundesamt							
Station: Waldhof							
Date of checking list: 27.05.2019							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS			ST	39.0	OFF	
Firmware Classifier:	TROPOS			CT	22.0	5 V	
Firmware Software:	6.68			OT	40.0	10 V	
DMA type:	Vienna		177	CabT	34.6	1000 V	
CPC model:	TSI CPC 3772-CEN			AP	98.5	250 V	
Firmware CPC:	6.0			OP	67.1	5 V	
radioactive source:	Kr.85	77A-0722		NP	0.4	400 V	
Aerosol Nafion Dryer		MD-110-12E-S 072717-17-09					
Sheath Nafion Dryer		ND0.7-187E					
Aerosol inlet dryer		ND0.7-206					
Flow CPC (l/min):				LC	42	600 V	
Flow Inlet (l/min):	0.987					800 V	
Flow Display (l/min):						700 V	
Zero (#/cm³):						650 V	
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:	System running with nafion						
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:							
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:							
Impactor:							
Setup settings over night:	Capillary reinstalled						

<i>Institute:</i> TROPOS							
<i>Station:</i> Reference Instrument No.1							
<i>Date of checking list:</i> 27.05.2019							
<i>Instrument/ Components</i>	<i>info</i>	<i>Serial Number</i>	<i>Date/Code</i>	<i>CPC-Status</i>		<i>HV-Status</i>	
<i>MPSS/Classifier:</i>	TROPOS	No.1		<i>ST</i>		<i>0 V</i>	
<i>Firmware Classifier:</i>				<i>CT</i>		<i>5 mV</i>	
<i>Firmware Software:</i>	TROPOS 6.68			<i>OT</i>		<i>800 mV</i>	
<i>DMA type:</i>	Hauke medium		142	<i>CabT</i>		<i>200 mV</i>	
<i>CPC model:</i>	TSI 3772	3772141701		<i>AP</i>		<i>0 V</i>	
<i>Firmware CPC:</i>	2.15			<i>OP</i>			
<i>Radioactive source:</i>	Kr.85	NER 8275	002/13	<i>NP</i>			
<i>Flow Inlet (l/min):</i>	1.02			<i>LC</i>			
<i>Zero (#/cm³):</i>	0						

Institute: TROPOS					
Station: Reference Total CPC					
Date of checking list: 27.05.2019					
Instrument/ Components	info	Serial Number	Cut off	CPC-Status	
CPC model:	TSI 3010	2410	D _{p50} 10 nm	ST	
Firmware CPC:	2.15			CT	
Flow Inlet (l/min):	1.01			OT	
Zero (#/cm ³):	0			CabT	
				AP	
				OP	
				NP	
				LC	

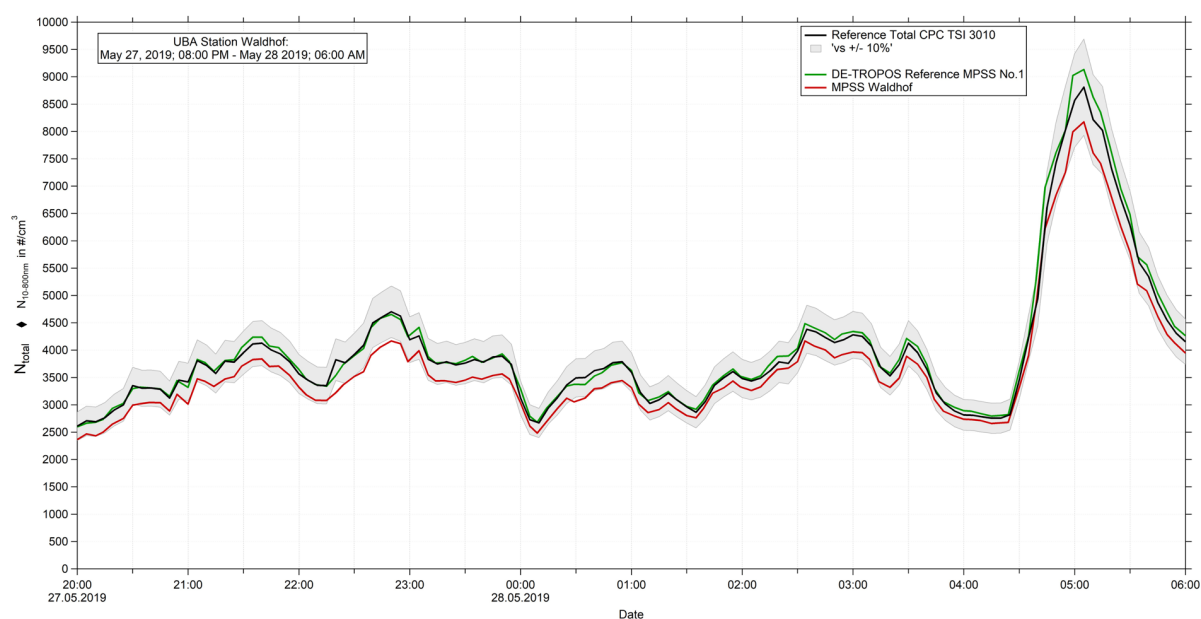


Figure 25: Time series (May 27, 2019 8 PM – May 28, 2019 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

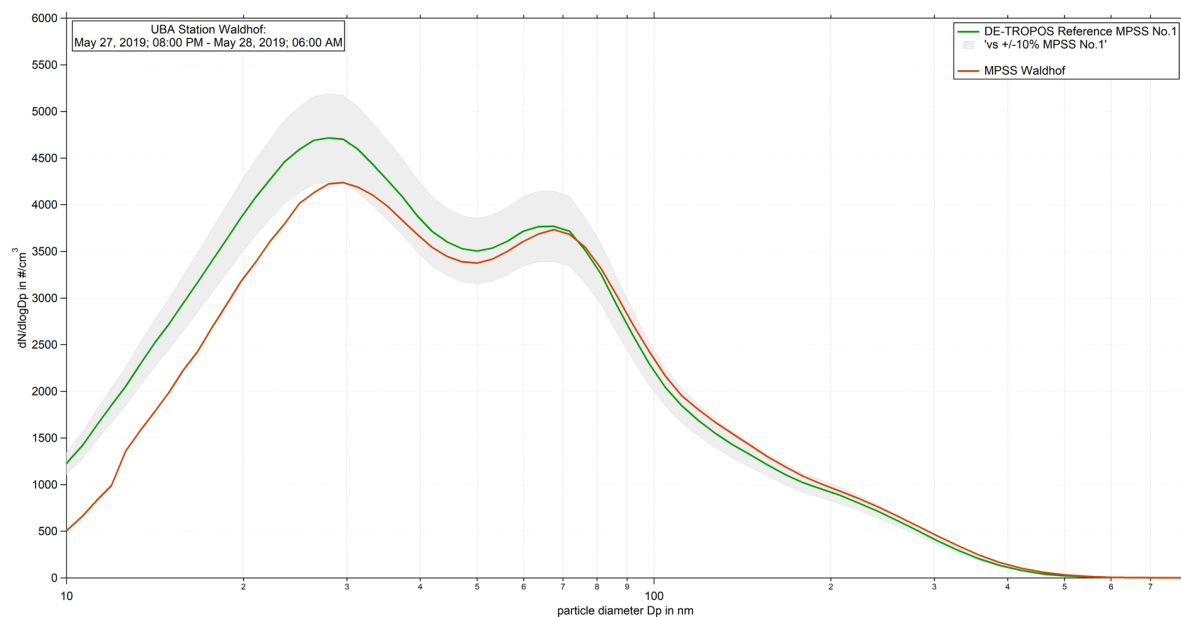


Figure 26: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Waldhof MPSS from May 27, 2019 8 PM – May 28, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

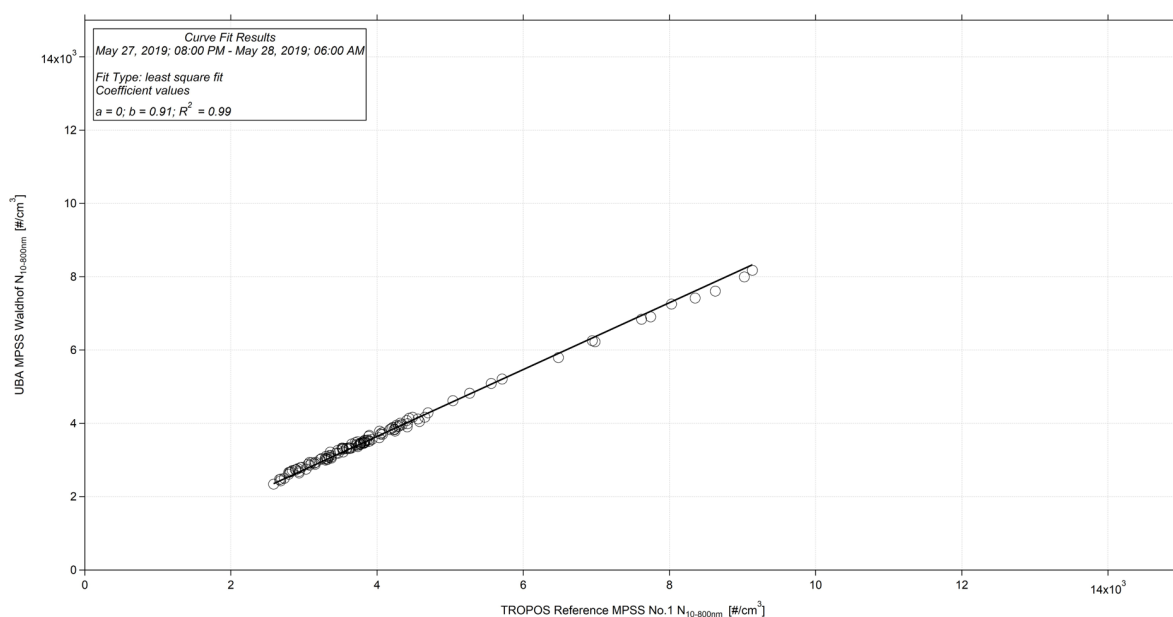


Figure 27: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Waldhof. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final-Status May 28 – 29, 2019**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 4:

Institute: Umweltbundesamt							
Station: Waldhof							
Date of checking list: 28.05.2019							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS			ST	39.0	OFF	
Firmware Classifier:	TROPOS			CT	22.0	5 V	
Firmware Software:	6.68			OT	40.0	10 V	
DMA type:	Vienna		177	CabT	34.6	1000 V	
CPC model:	TSI CPC 3772-CEN			AP	98.5	250 V	
Firmware CPC:	6.0			OP	67.1	5 V	
radioactive source:	Kr.85	77A-0722		NP	0.4	400 V	
Aerosol Nafion Dryer		MD-110-12E-S 072717-17-09					
Sheath Nafion Dryer		ND0.7-187E					
Aerosol inlet dryer		ND0.7-206					
Flow CPC (l/min):				LC	42	600 V	
Flow Inlet (l/min):	0.987					800 V	
Flow Display (l/min):						700 V	
Zero (#/cm ³):						650 V	
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:	System running with nafion						
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:							
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:							
Impactor:							
Setup settings over night:	Capillary reinstalled						

Institute: TROPOS							
Station: Reference Instrument No.1							
Date of checking list: 28.05.2019							
Instrument/ Components	info	Serial Number	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TROPOS	No.1		ST		0 V	
Firmware Classifier:				CT		5 mV	
Firmware Software:	TROPOS 6.68			OT		800 mV	
DMA type:	Hauke medium		142	CabT		200 mV	
CPC model:	TSI 3772	3772141701		AP		0 V	
Firmware CPC:	2.15			OP			
Radioactive source:	Kr.85	NER 8275	002/13	NP			
Flow Inlet (l/min):	1.02			LC			
Zero (#/cm ³):	0						

Institute: TROPOS					
Station: Reference Total CPC					
Date of checking list: 28.05.2019					
Instrument/ Components	info	Serial Number	Cut off	CPC-Status	
CPC model:	TSI 3010	2410	D _{p50} 10 nm	ST	
Firmware CPC:	2.15			CT	
Flow Inlet (l/min):	1.01			OT	
Zero (#/cm ³):	0			CabT	
				AP	
				OP	
				NP	
				LC	

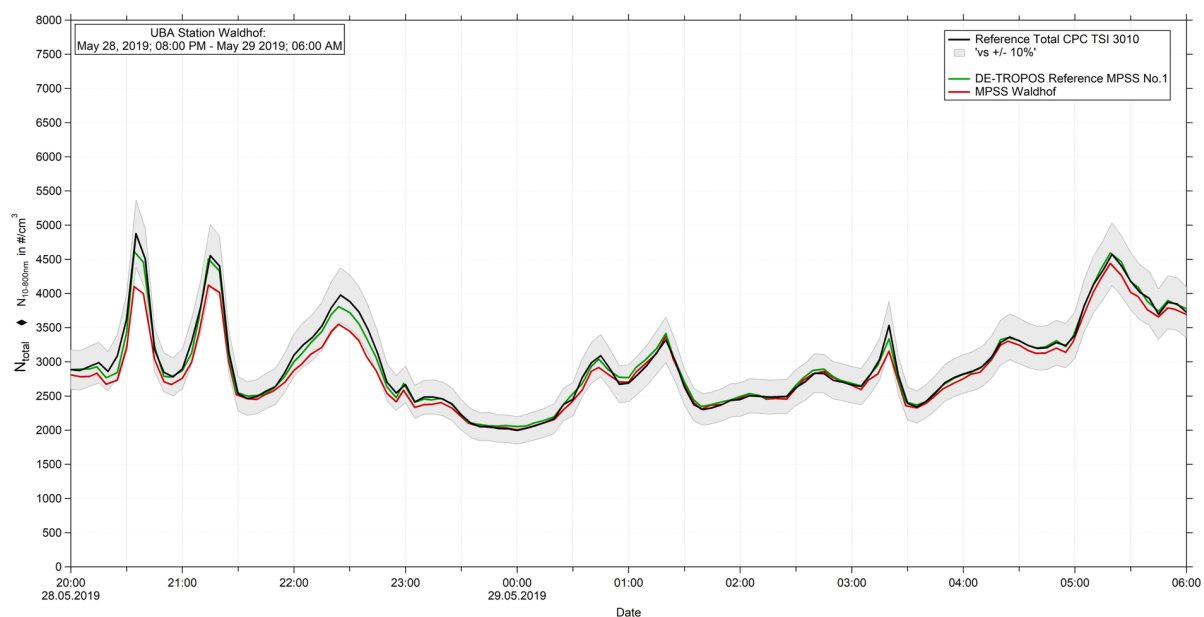


Figure 28: Time series (May 28, 2019 8 PM – May 29, 2019 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

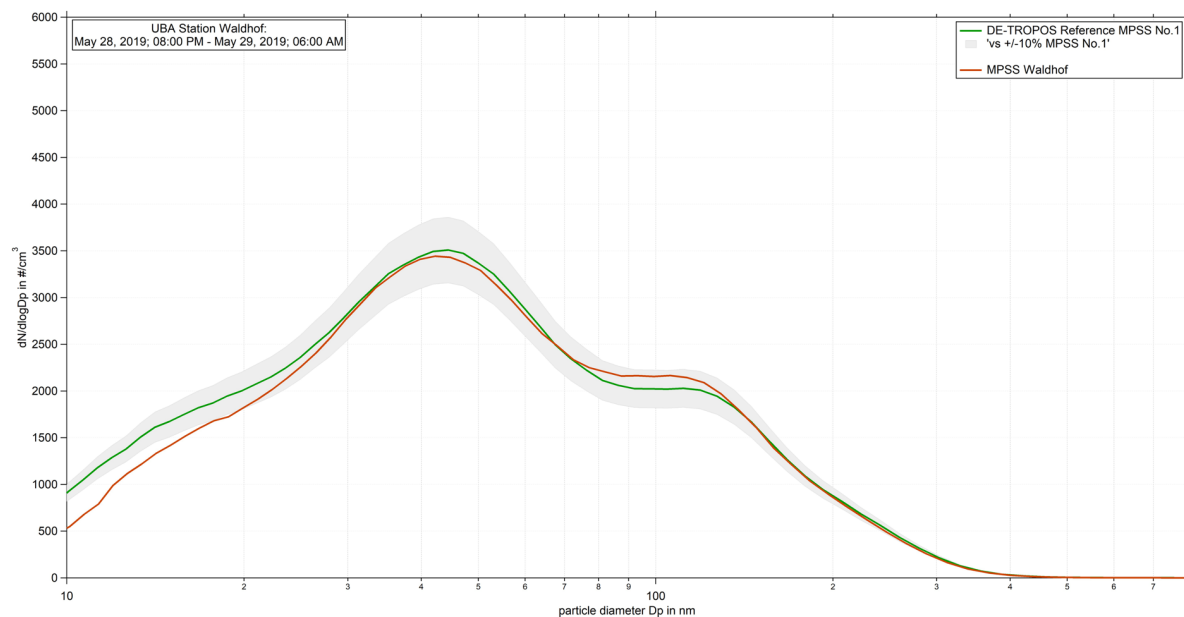


Figure 29: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Waldhof MPSS from May 27, 2019 8 PM – May 28, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

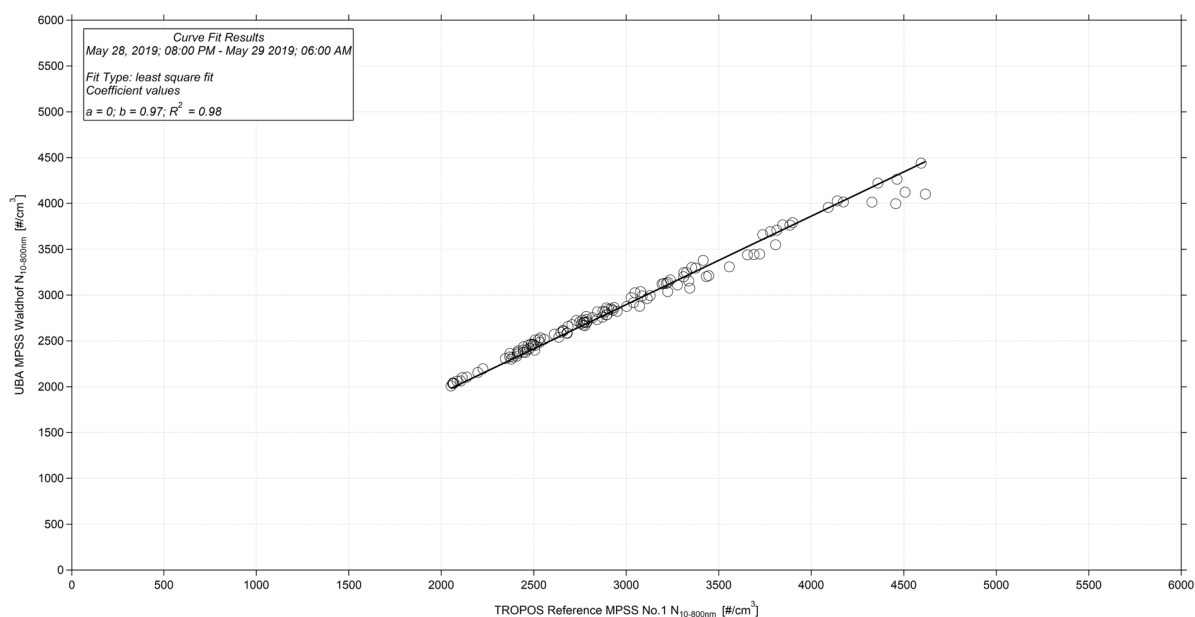


Figure 30: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Waldhof. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

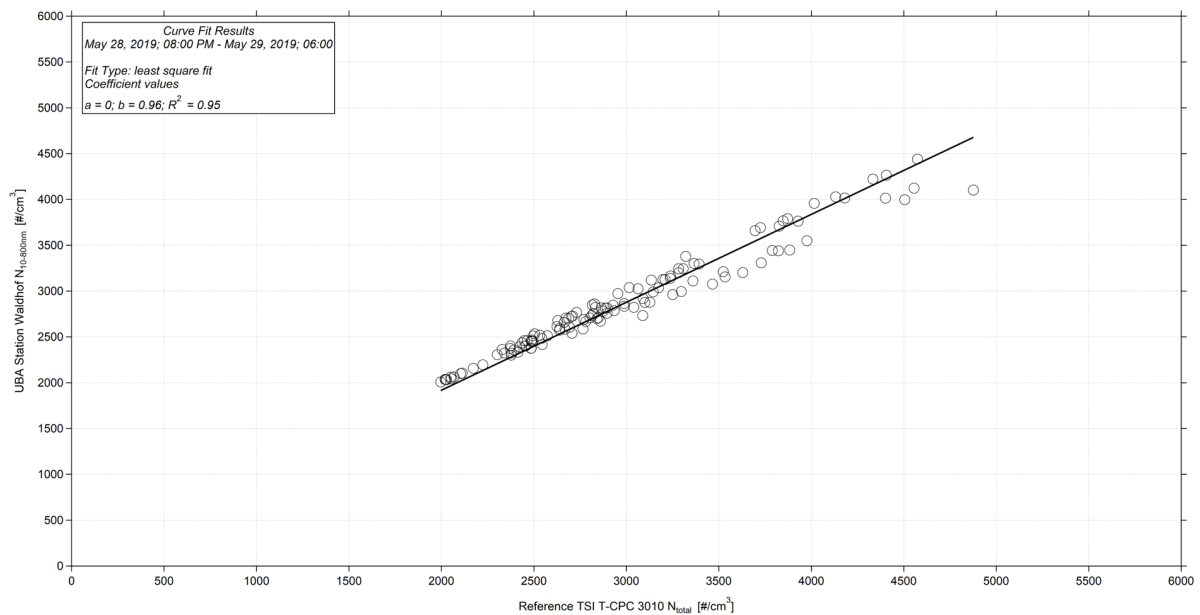


Figure 31: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and UBA-Waldhof. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

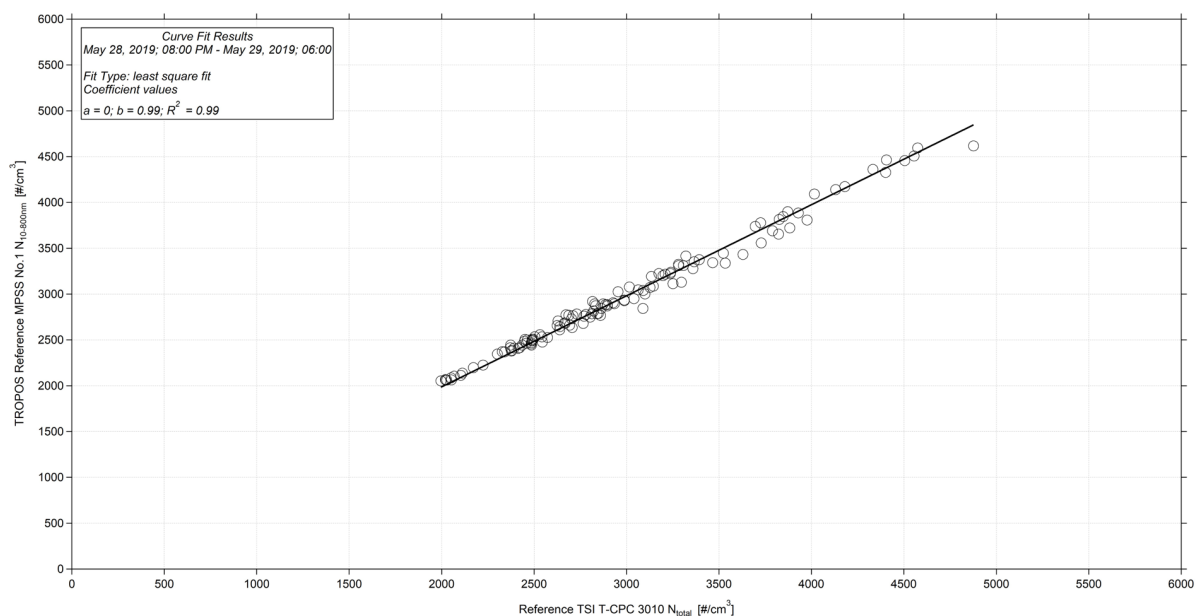


Figure 32: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference TSI T-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC efficiency are included.