

Intercomparison of Mobility Particle Size Spectrometers

Project No.: MPSS-2019-2-3

Principal Investigator: Ralf Sohmer

Home Institution:

Participant: Ralf Sohmer

Candidate: MPSS Zugspitze

Made by: TROPOS Homemade

Counter (SN): 3772161407

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:

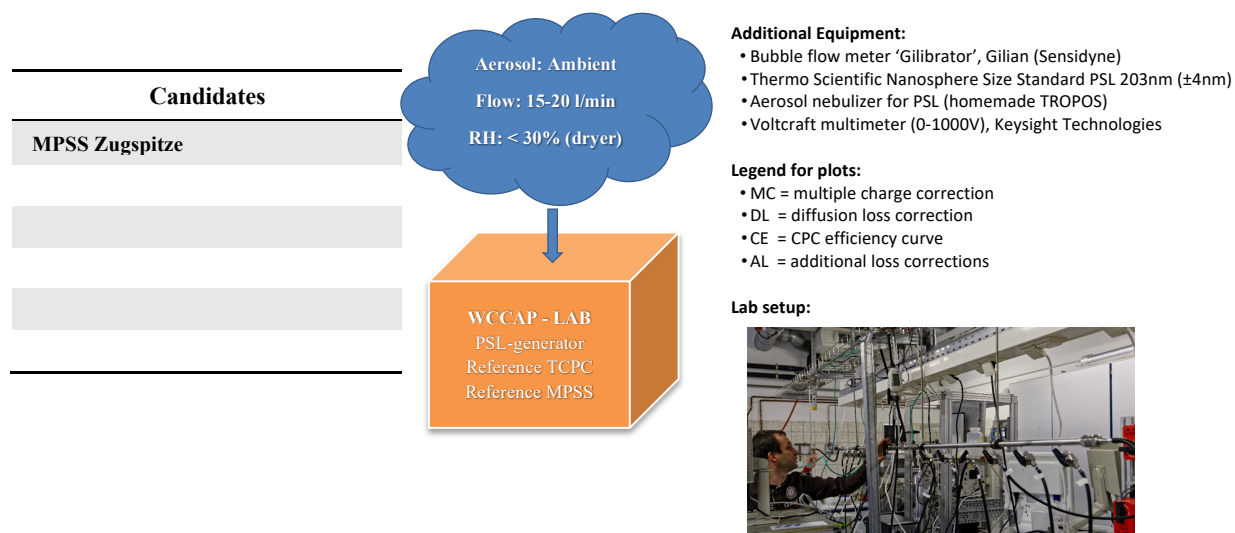
Pre-Status:

The candidate from UBA-Zugspitze 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 1% Higher 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 checked and cleaned. More details are in the Tables for each night run. The participant was instructed and trained how to optimize his instrument. In addition, the station setup and quality assurance procedures were discussed.

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 2% higher than the TROPOS Reference Instrument No.1. The Electronic box had to be checked and repaired due to instability in the high voltage provided, also the grounding was checked. The candidate passed the standards of ACTRIS and GAW under the conditions, using the TROPOS Reference CPC No.1.

Laboratory Setup and Legend



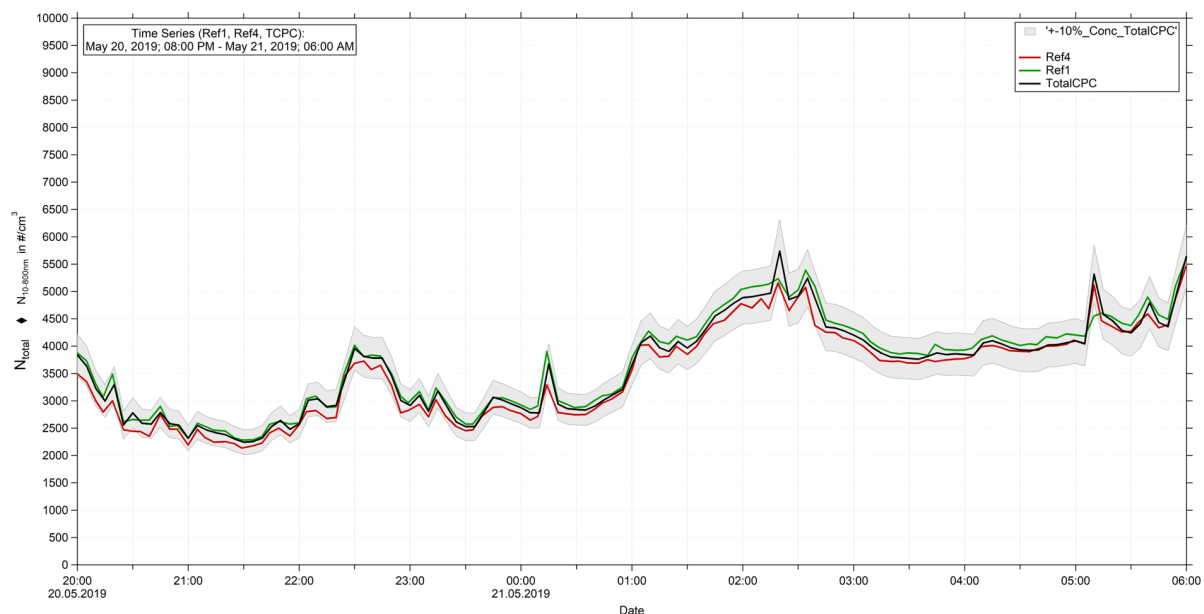
TROPOS Reference Instruments No. 1 and No. 4**May 20 – May 21, 2019: Time Series, Particle Number Size Distribution and Correlation**

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.

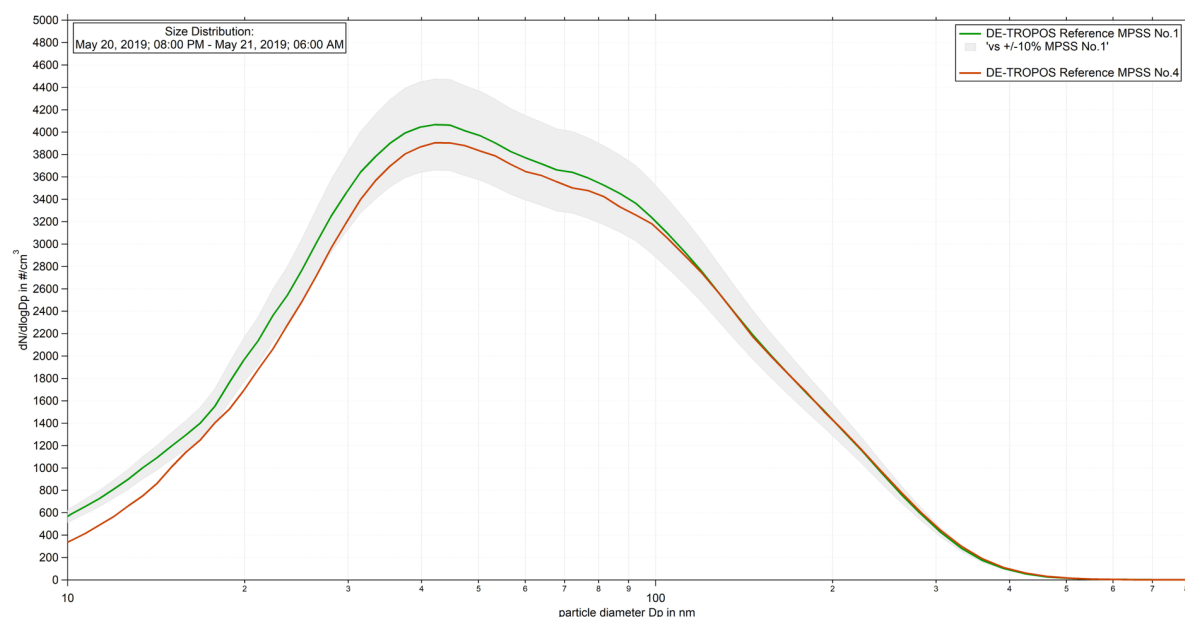


Figure 02: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against TROPOS Reference MPSS No.4 from May 20, 2019 8 PM – May 21, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

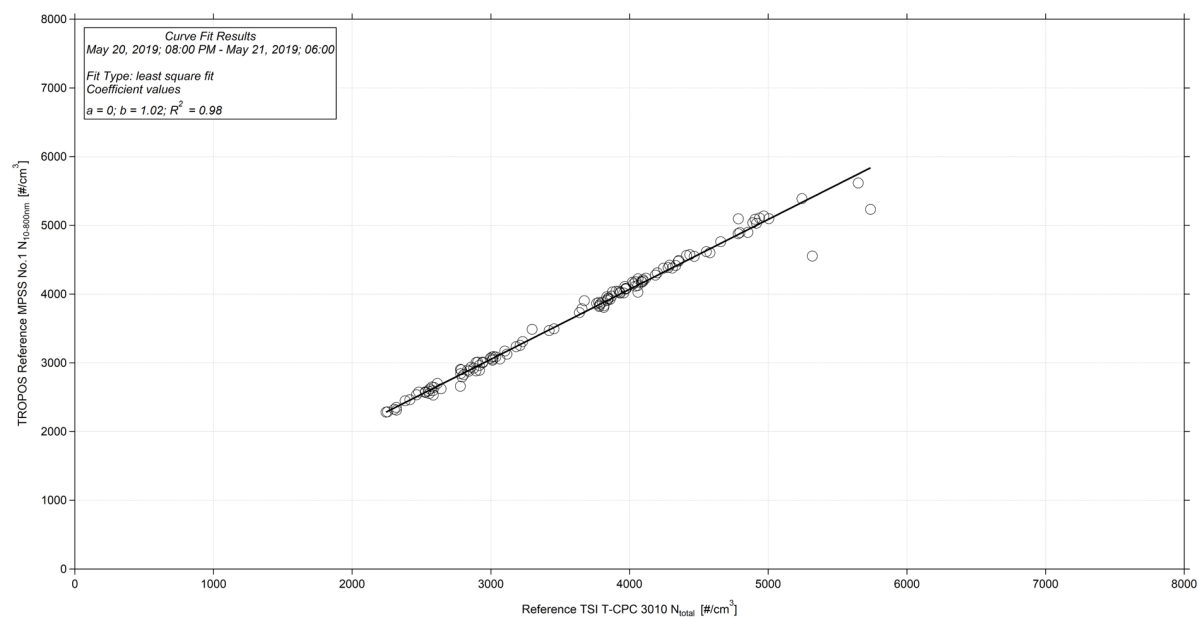


Figure 03: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

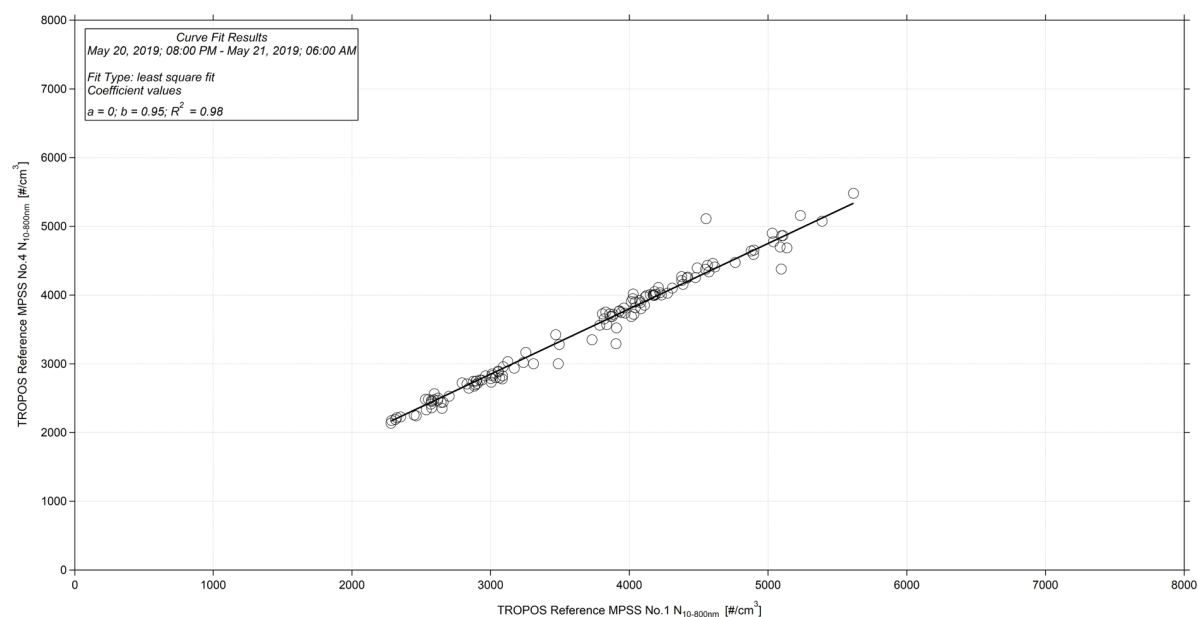


Figure 04: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

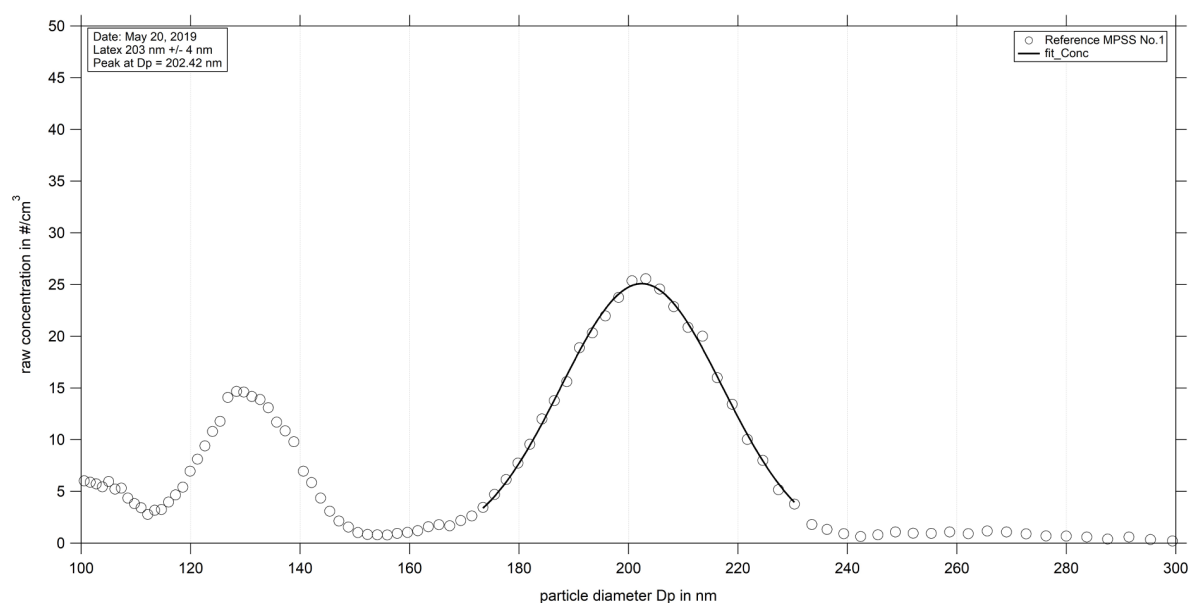
PSL Scan: Latex 203 nm +/- 4 nm

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

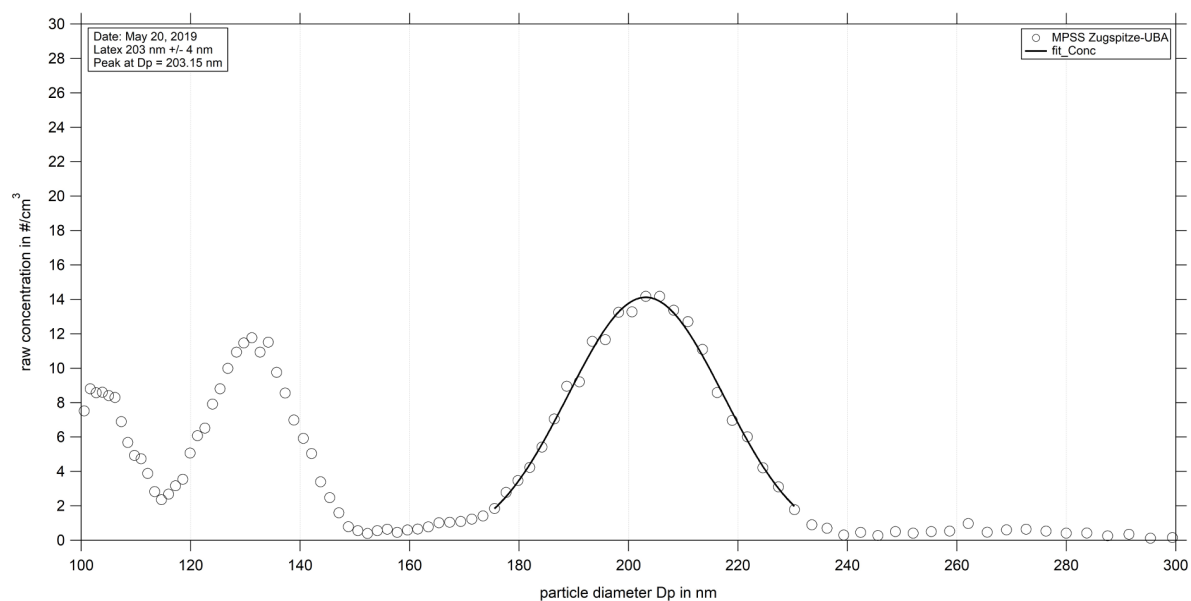


Figure 06: Measurement of latex 203 nm for the candidate UBA-Zugspitze MPSS: Particle size distribution for latex 203 nm on October 20th 2019 with a peak at 203.15 nm.

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

Table No. 1:

Institute: Umweltbundesamt							
Station: Zugspitze							
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	0
Firmware Software:	6.68			OT	40.0	1000 V	988.1
DMA type:	Vienna		201	CabT	31.6		
CPC model:	TSI CPC 3772	3772161407		AP	98.2	5 V	5.2
Firmware CPC:	2.15			OP	82.7	1000 V	999.8
radioactive source:	Ni.63			NP	2.5	200 V	249.9
Flow CPC (l/min):				LC	40	5 V	5.2
Flow Inlet (l/min):	1.014					0	0
Flow Display (l/min):							
Zero (#/cm ³):							
Aerosol nafion dryer	-						
Sheath air nafion dryer	ND0.7-107a						
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:				System doesn't have a 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	

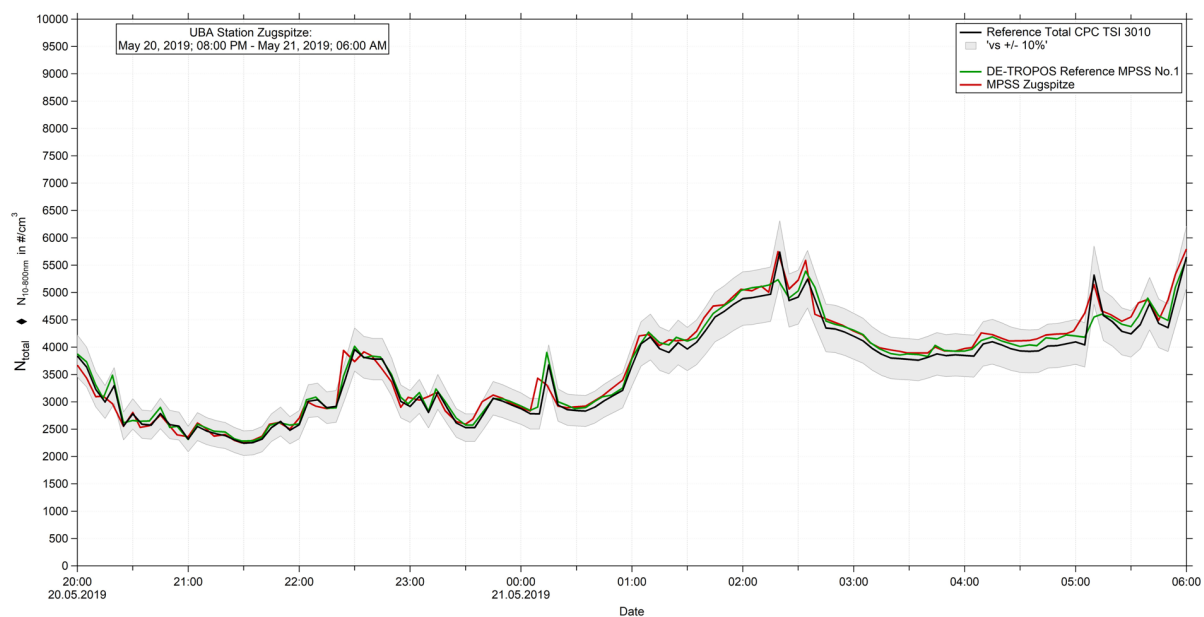


Figure 08: Time series (May 20, 2019 8 PM – May 21, 2019 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections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

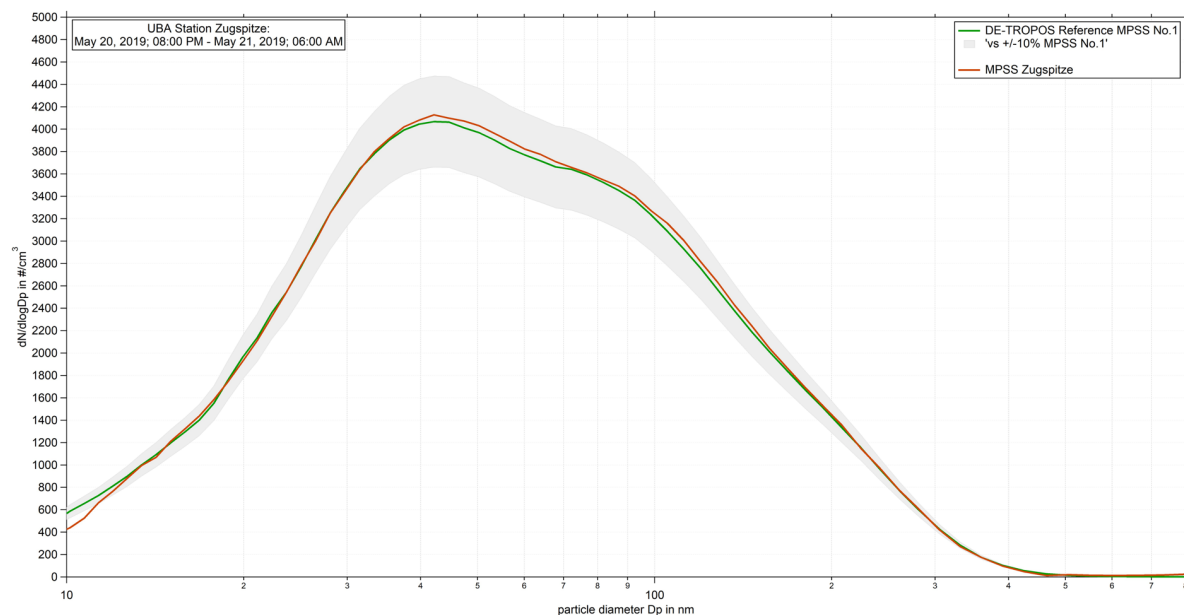


Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Zugspitze MPSS from May 20, 2019 8 PM – May 21, 2019 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

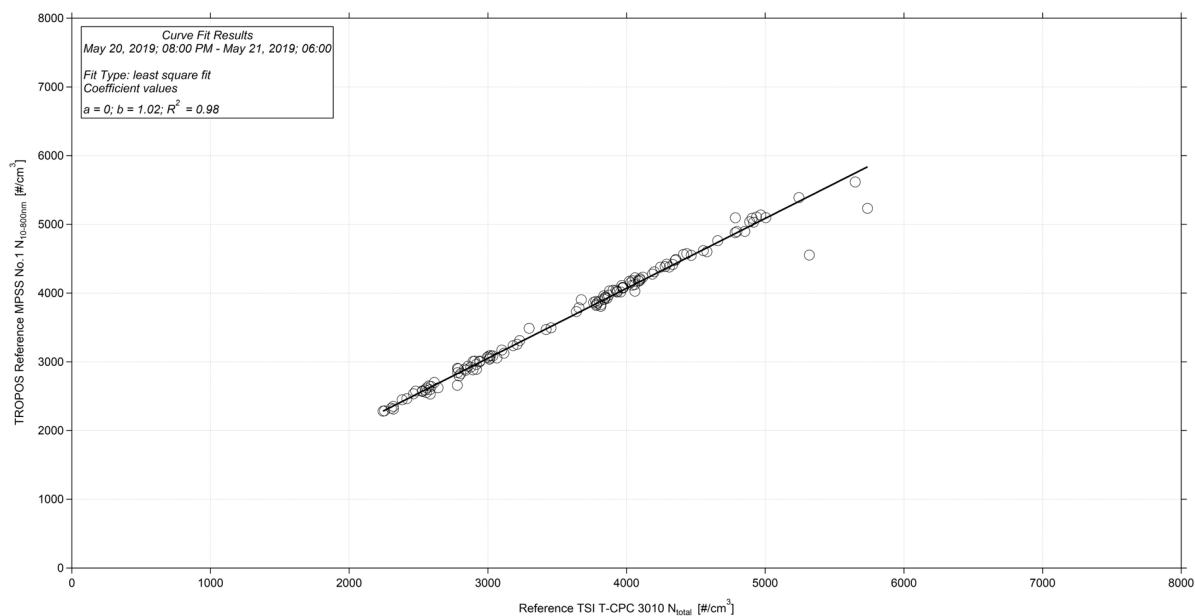


Figure 10: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

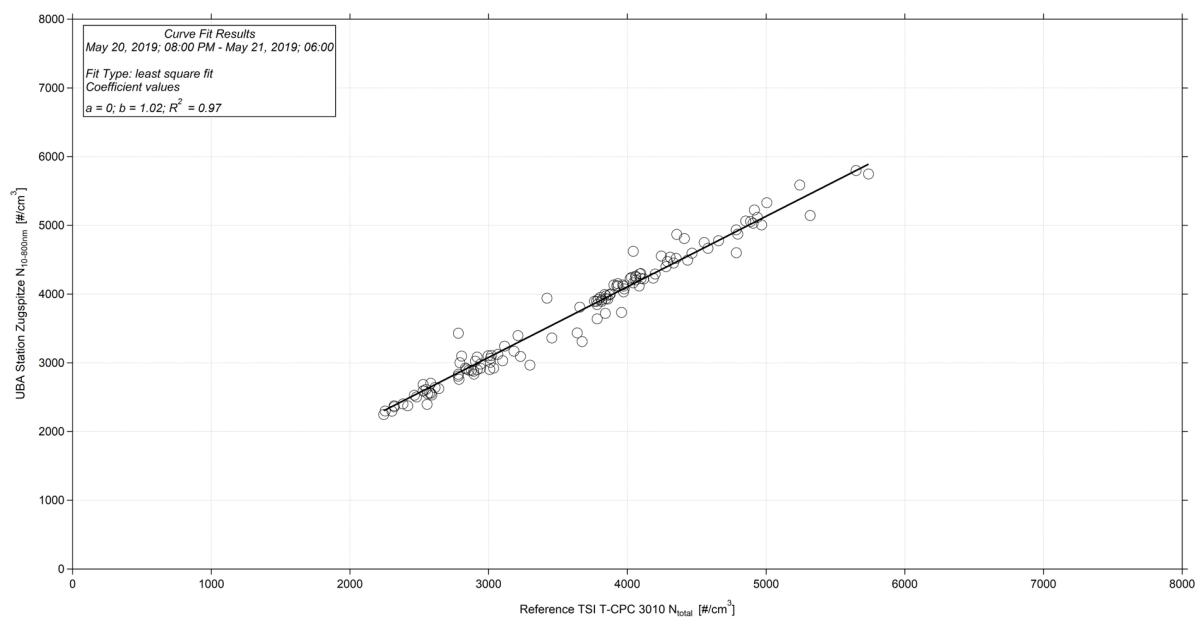


Figure 11: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

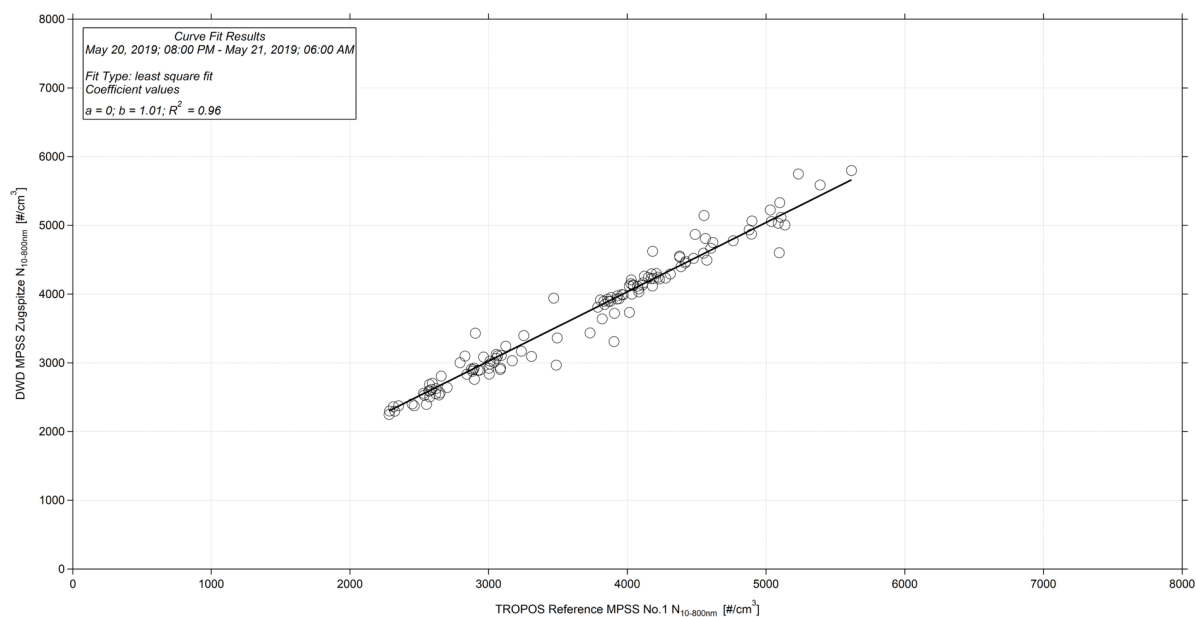


Figure 12: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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

Table No. 2:

Institute: Umweltbundesamt							
Station: Zugspitze							
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	0
Firmware Software:	6.68			OT	40.0	1000 V	988.1
DMA type:	Vienna		201	CabT	31.6		
CPC model:	TSI CPC 3772	3772161407		AP	98.2	5 V	5.2
Firmware CPC:	2.15			OP	82.7	1000 V	999.8
radioactive source:	Ni.63			NP	2.5	200 V	249.9
Flow CPC (l/min):				LC	40	5 V	5.2
Flow Inlet (l/min):	1.014					0	0
Flow Display (l/min):							
Zero (#/cm ³):							
Aerosol nafion dryer	-						
Sheath air nafion dryer	ND0.7-107a						
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:						System doesn't have a 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 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 (#/cm³):	0			CabT	
				AP	
				OP	
				NP	
				LC	

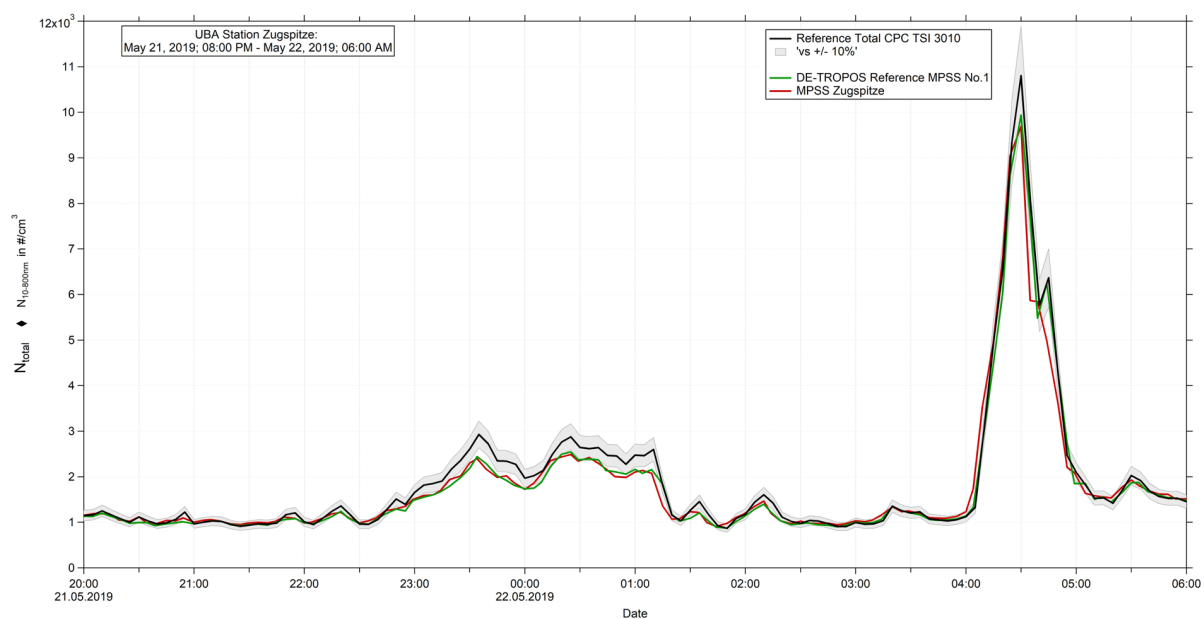


Figure 13: Time series (May 21, 2019 8 PM –May 22, 2019 6 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are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

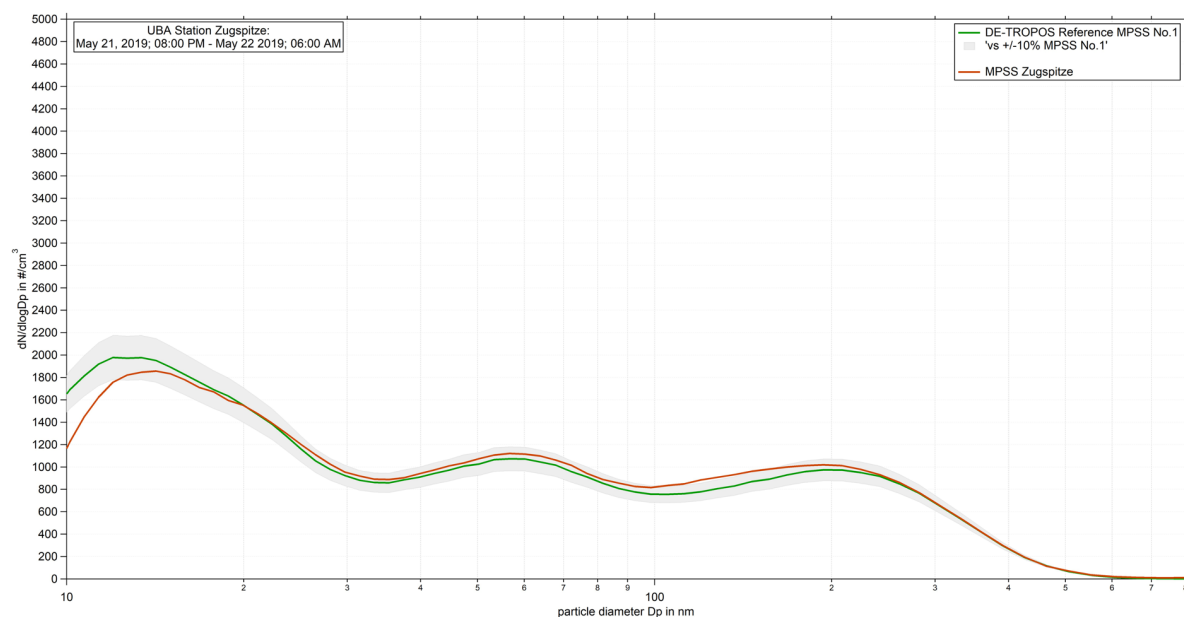


Figure 14: Comparison of median particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Zugspitze MPSS from May 21, 2019 8 PM – May 22, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

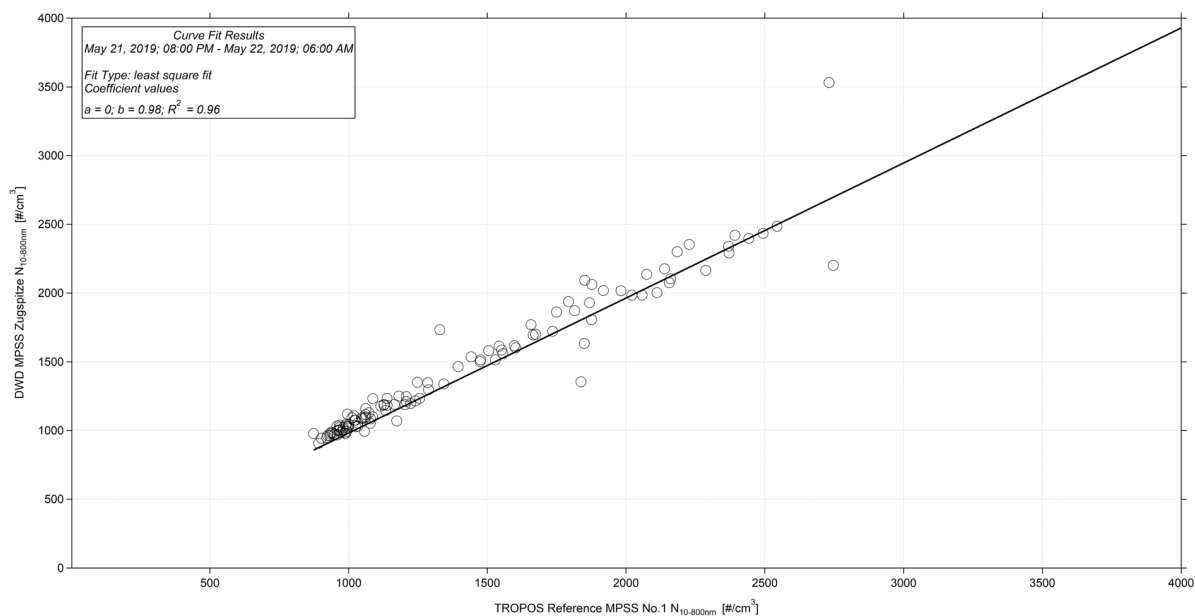


Figure 15: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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

Table No. 2:

Institute: Umweltbundesamt							
Station: Zugspitze							
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	2.9
Firmware Software:	6.68			OT	40.0	1000 V	998.2
DMA type:	Vienna		201	CabT	31.6		
CPC model:	TSI CPC 3772	3772161407		AP	98.2	5 V	5.2
Firmware CPC:	2.15			OP	82.7	1000 V	999.9
radioactive source:	Ni.63			NP	2.5	200 V	250.1
Flow CPC (l/min):				LC	40	5 V	5.2
Flow Inlet (l/min):	1.007					0	0.2
Flow Display (l/min):							
Zero (#/cm ³):							
Aerosol nafion dryer	-						
Sheath air nafion dryer	ND0.7-107a						
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:						No nafion	
Sheath Nafion dryer:							
Source:							
HV power supply:						Change HV (HV Problem – not stable)	
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 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	

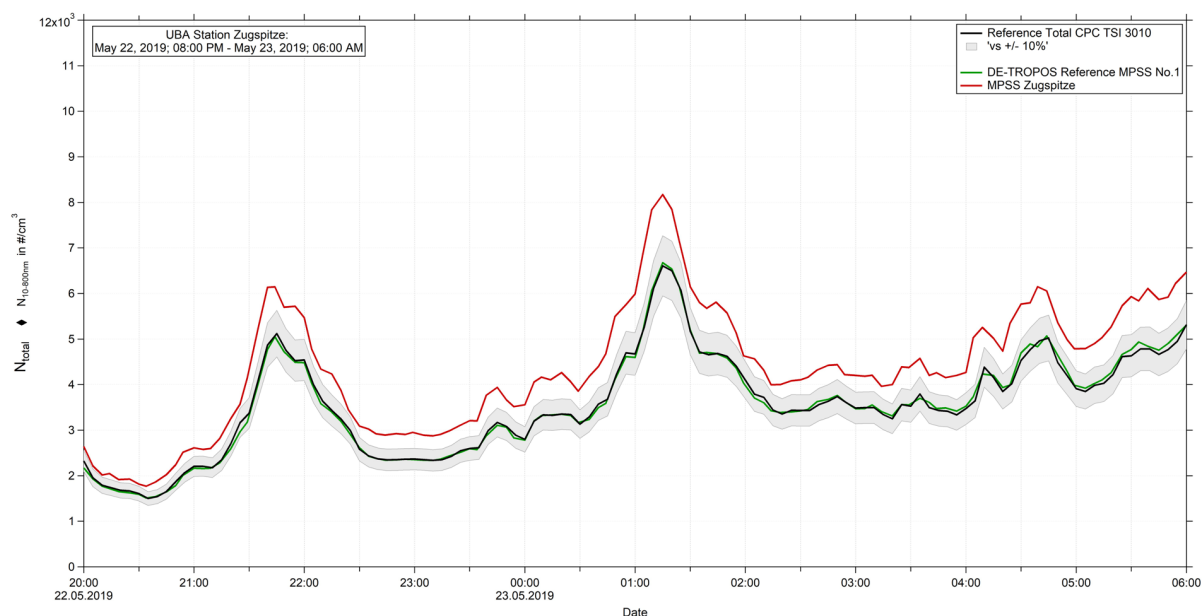


Figure 16: Time series (May 22, 2019 8 PM – May 23, 2019 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$ or $N_{10.6-500\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

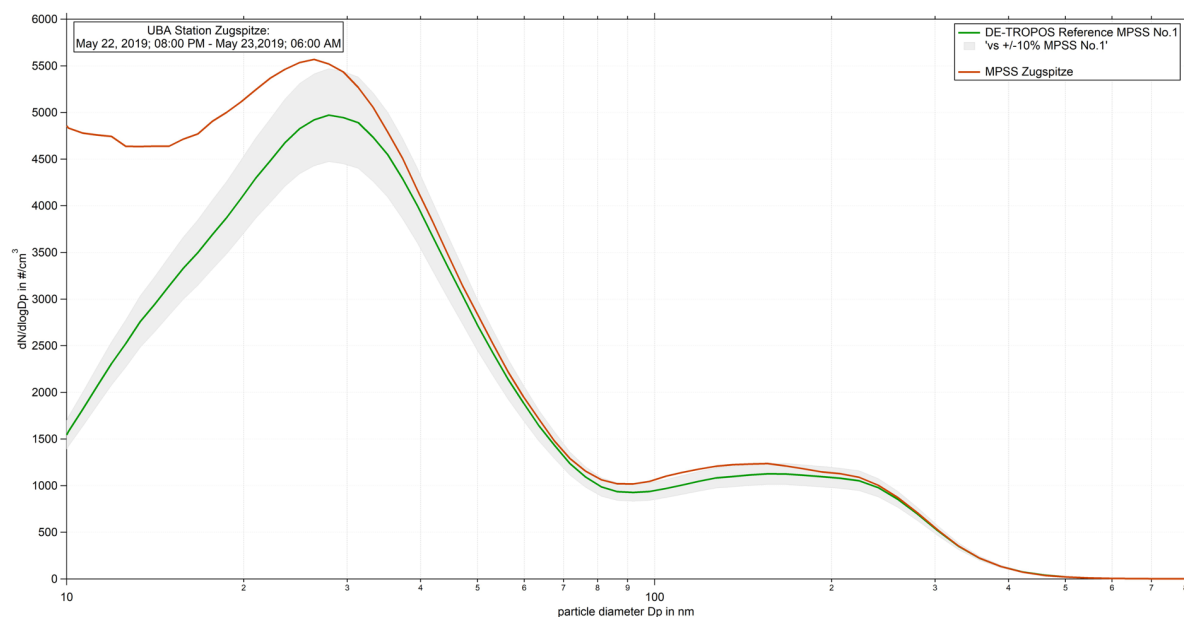


Figure 17: Comparison of median particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Zugspitze MPSS from May 22, 2019 8 PM – May 23, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

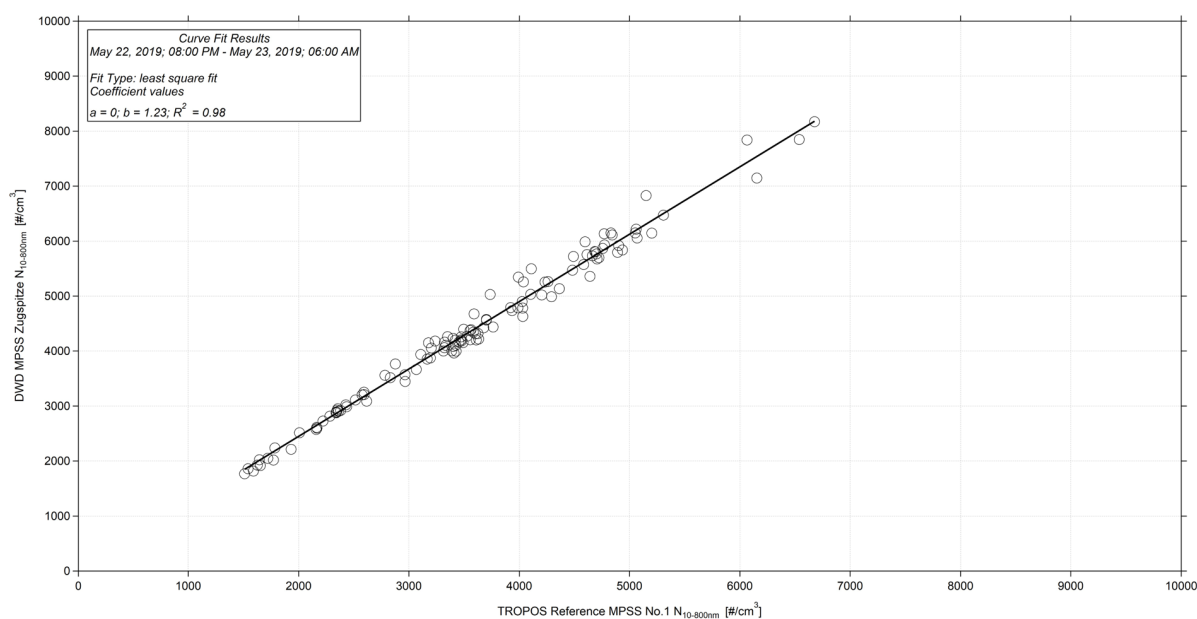


Figure 18: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status May 27 – 28, 2018**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 3:

Institute: Umweltbundesamt							
Station: Zugspitze							
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		201	CabT	31.6	1000 V	
CPC model:	TSI CPC 3772	3772161407		AP	98.2	250 V	
Firmware CPC:	2.15			OP	82.7	5 V	
radioactive source:	Ni.63			NP	2.5	400 V	
Flow CPC (l/min):				LC	40	600 V	
Flow Inlet (l/min):	1.007					800 V	
Flow Display (l/min):						700 V	
Zero (#/cm ³):						650 V	
Maintenance							
Aerosol inlet:	ND0.7-107a						
Aerosol Nafion dryer:	System without nafion						
Sheath Nafion dryer:							
Source:							
HV power supply:	HV grounding problem solved						
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 27, 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: May 27, 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	

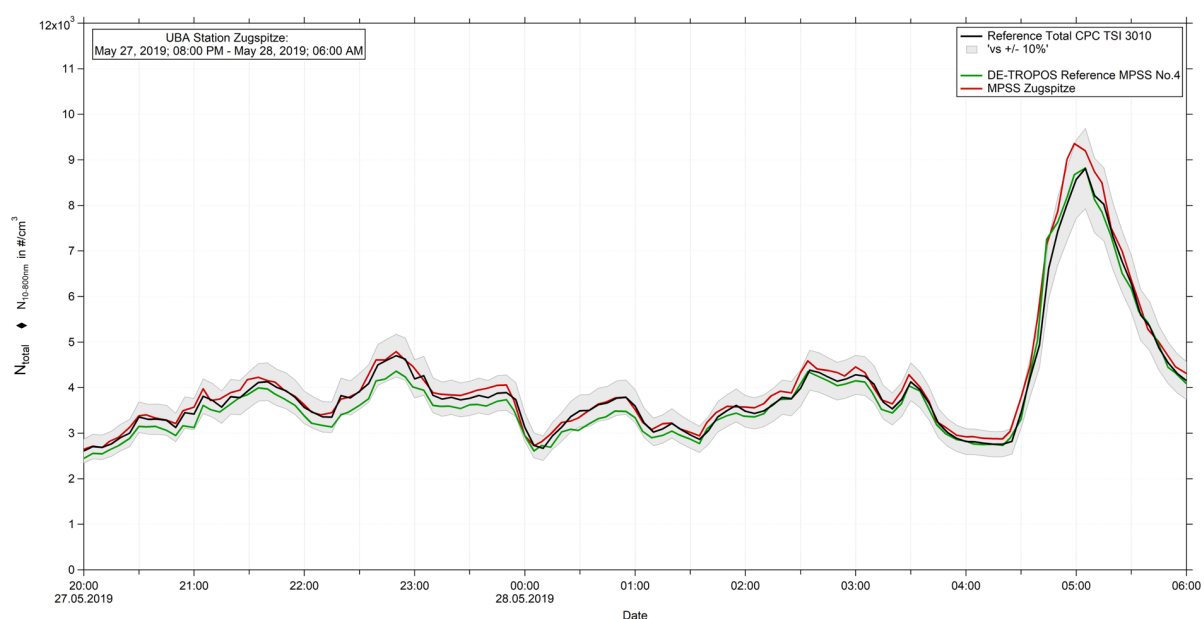


Figure 19: Time series (May 27, 2019 8 PM – May 28, 2019 6 AM) of the integrated particle number concentration ($N_{10,800\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

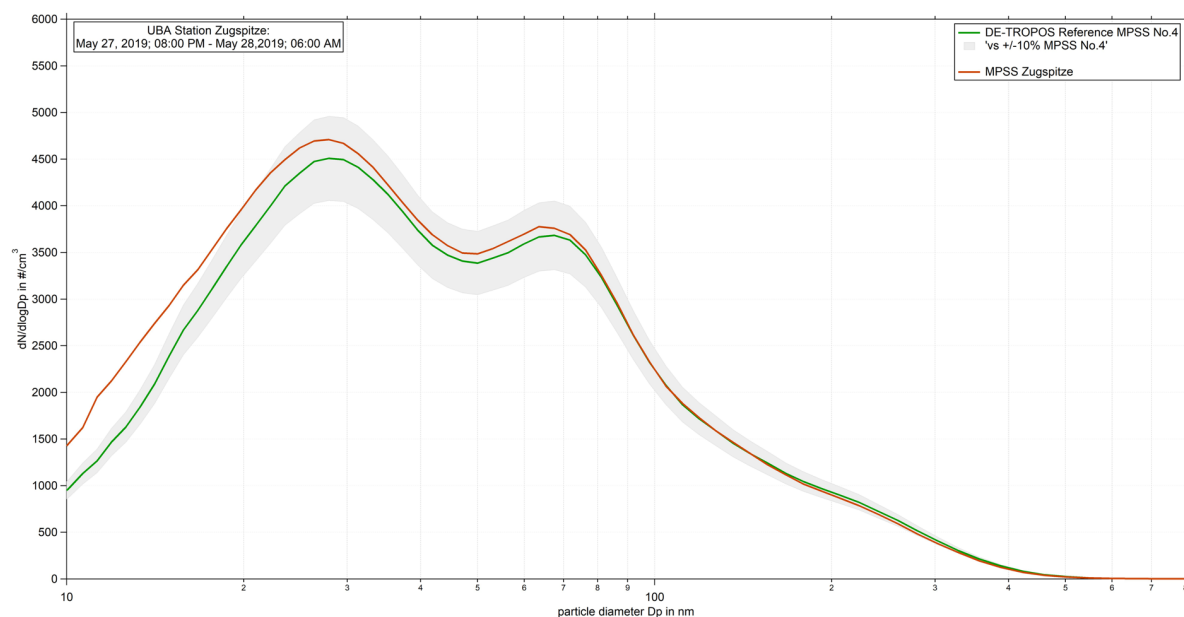


Figure 20: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against UBA-Zugspitze MPSS from May 27, 2019 8 PM – May 28, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

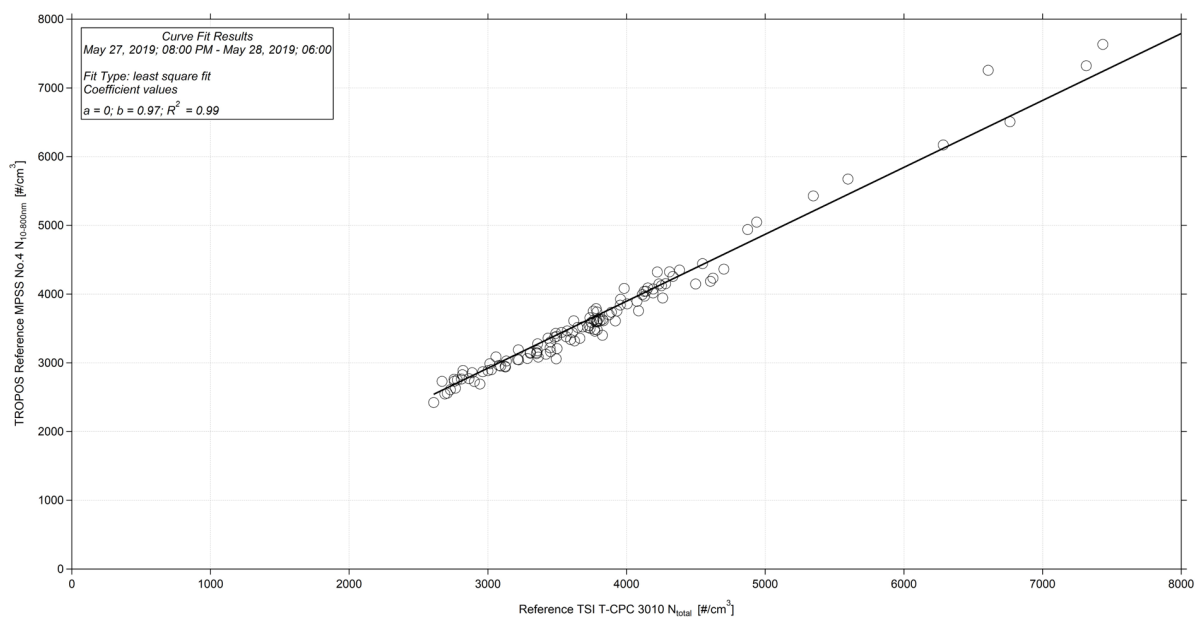


Figure 21: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

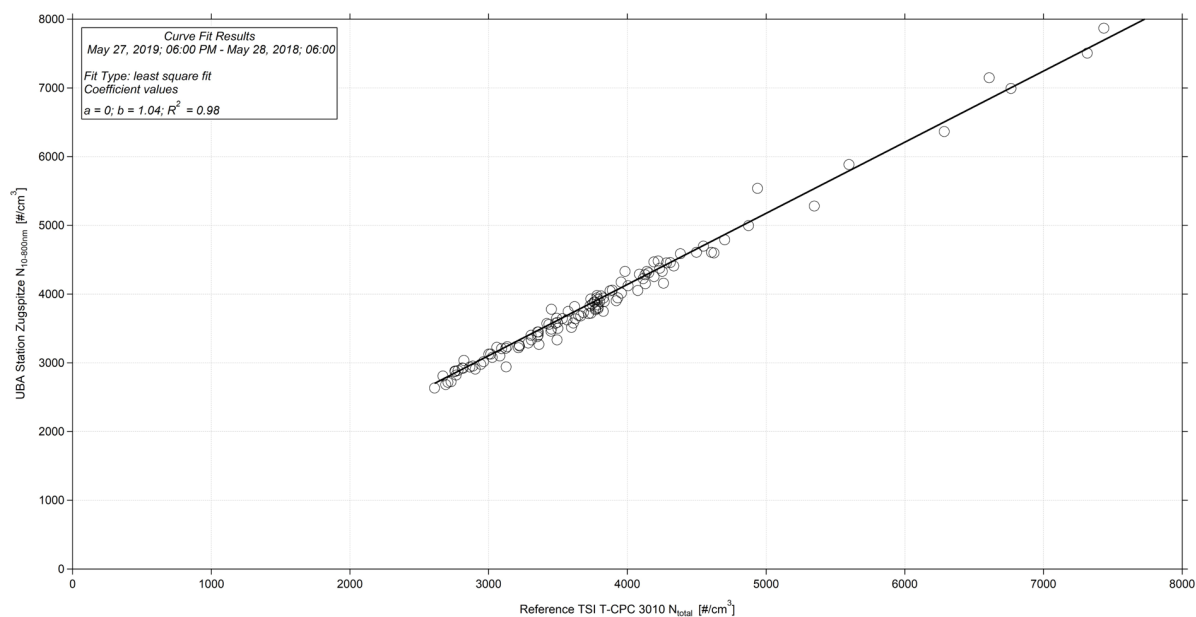


Figure 22: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

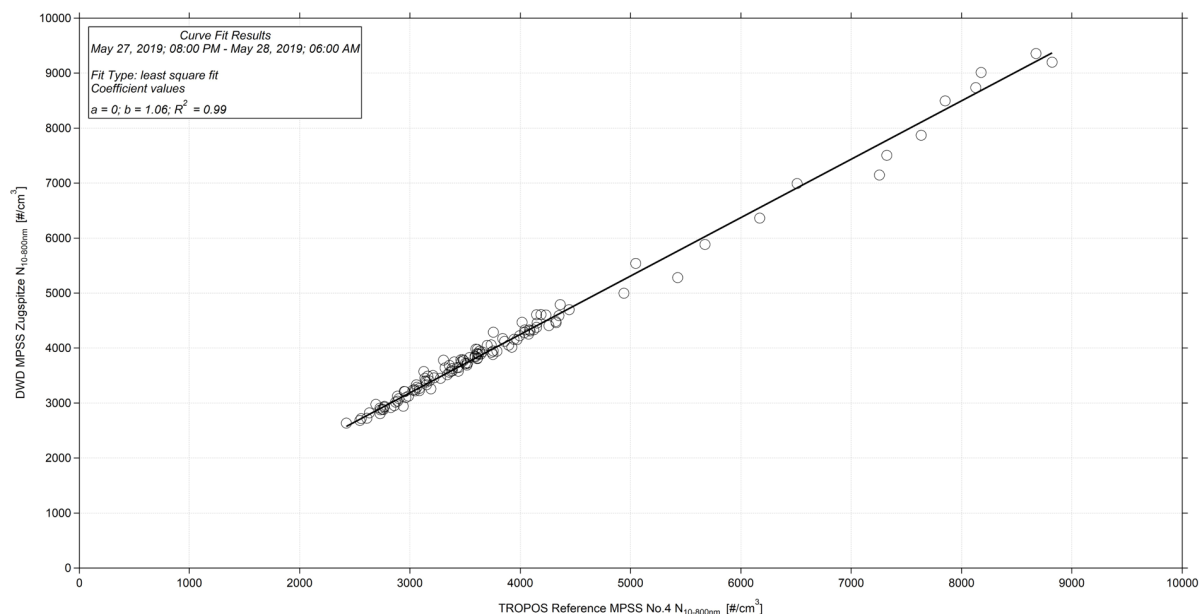


Figure 23: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final-Status May 28 – 29, 2018**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 3:

Institute: Umweltbundesamt							
Station: Zugspitze							
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		201	CabT	31.6	1000 V	
CPC model:	TSI CPC 3772	3772161407		AP	98.2	250 V	
Firmware CPC:	2.15			OP	82.7	5 V	
radioactive source:	Ni.63			NP	2.5	400 V	
Flow CPC (l/min):				LC	40	600 V	
Flow Inlet (l/min):	1.007					800 V	
Flow Display (l/min):						700 V	
Zero (#/cm ³):						650 V	

Institute: TROPOS							
Station: Reference Instrument No.1							
Date of checking list: May 28, 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: May 28, 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			

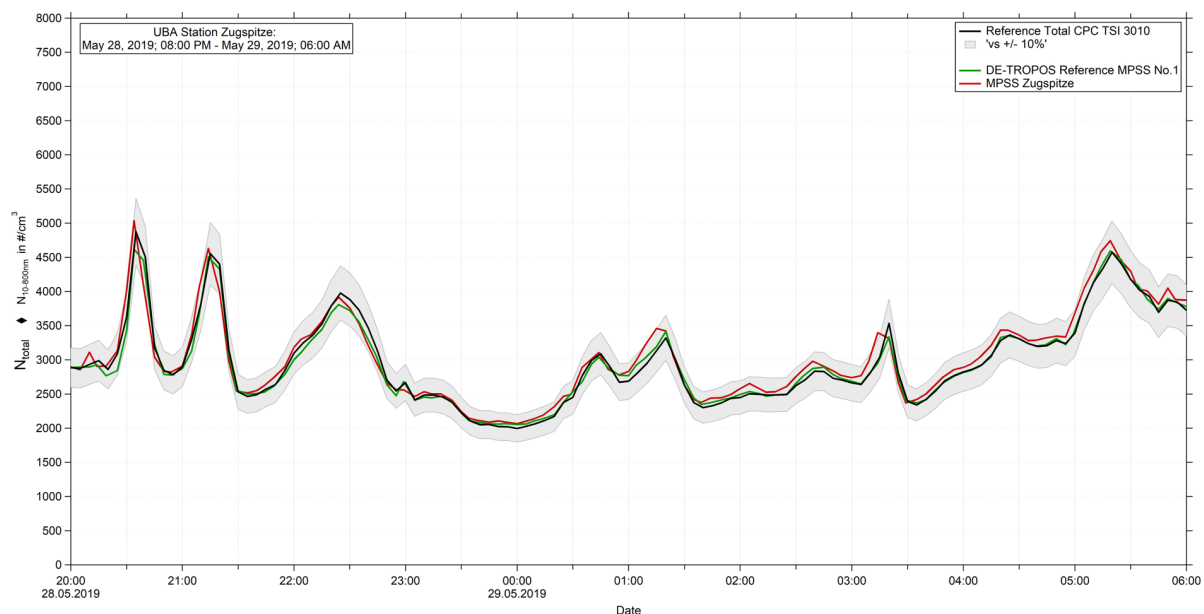


Figure 24: Time series (May 28, 2019 8 PM – May 29, 2019 6 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

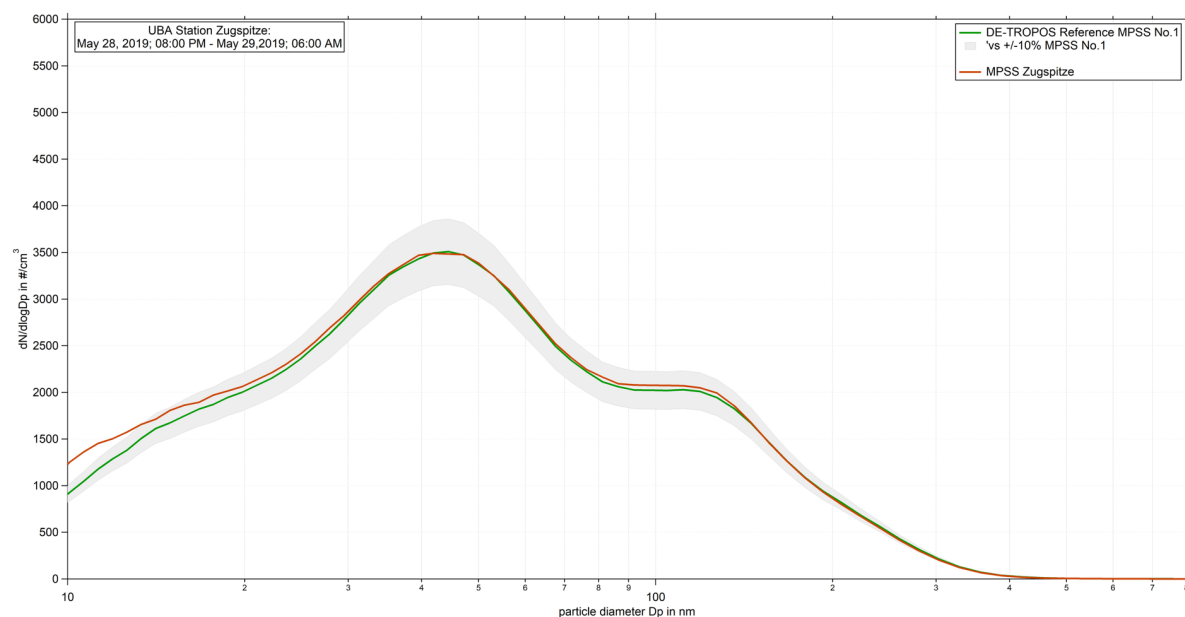


Figure 25: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Zugspitze MPSS from May 28, 2019 8 PM – May 29, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

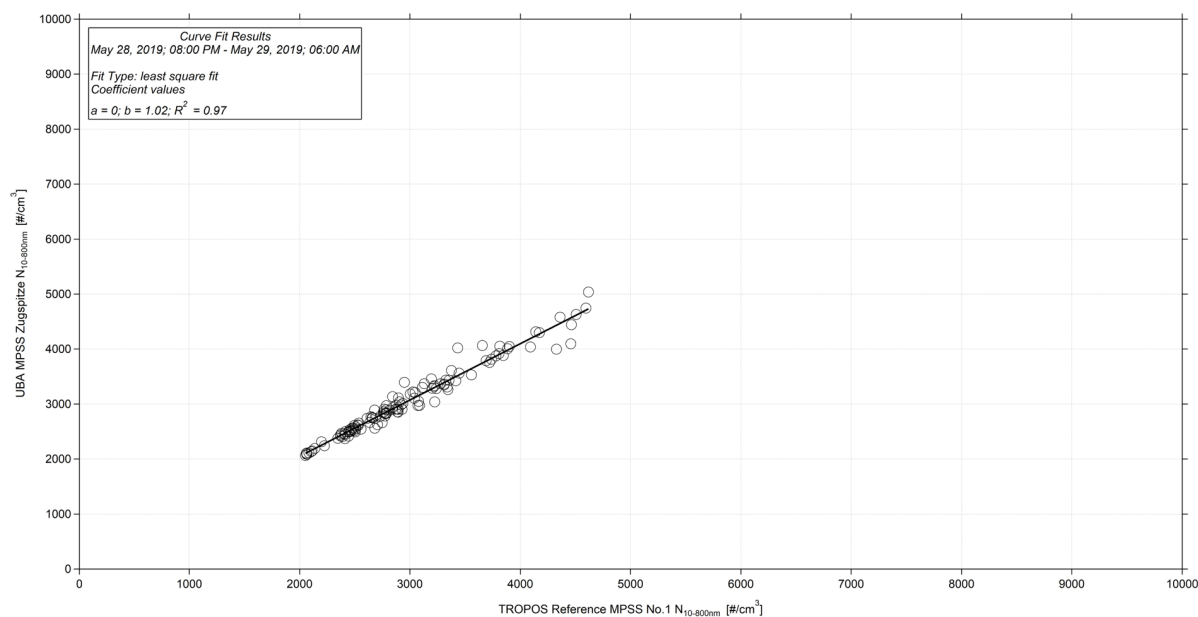


Figure 26: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

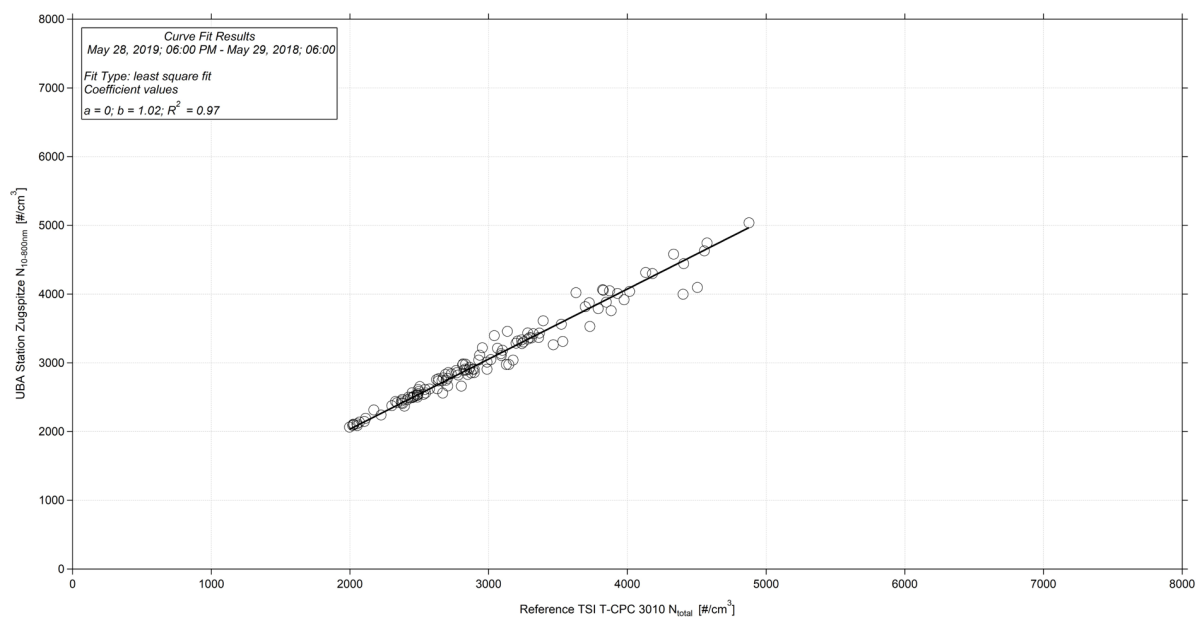


Figure 27: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

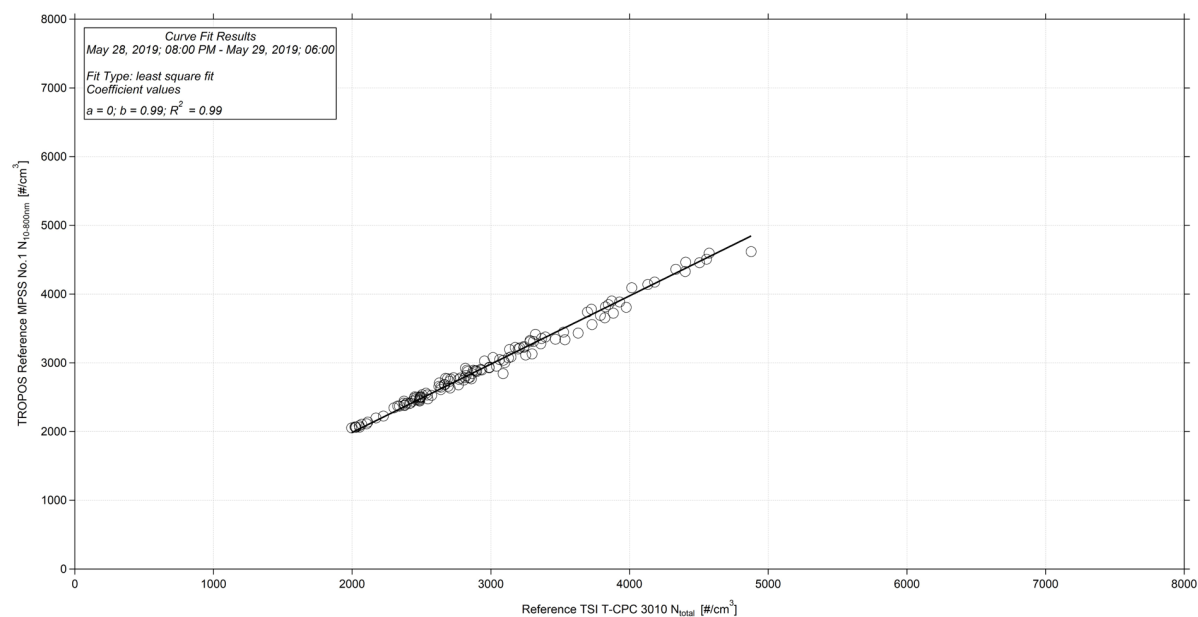


Figure 27: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Zugspitze MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.