Intercomparison of Mobility Particle Size Spectrometers

Project No.: Online   MPSS-2019-2-5

Principal Investigator: Frank Meinhardt

Home Institution: *Umweltbundesamt*

Participant: -

    Candidate: *MPSS Schauinsland*
    Made by: *TROPOS Homemade*
    Counter (SN):   *70738095*

Location of the quality assurance: TROPOS Leipzig, lab 118

Comparison period: May 20, 2019 – May 29, 2019

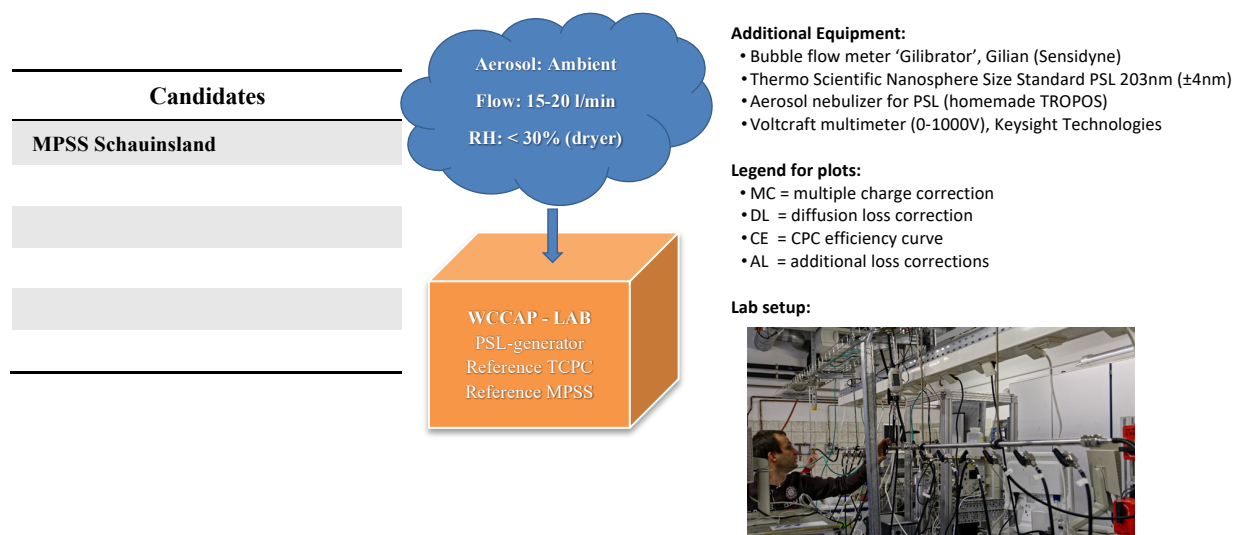Last Intercomparison (with Project No.):

Summary of Intercomparison:

Pre-Status:

The candidate from UBA-Schauinsland MPSS participated in the ACTRIS workshop from May 20, 2019 to May 29, 2019 without 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 and the CPC shows some sparks and has to be fixed. 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.

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 Total CPC from UBA-Schauinsland with the TROPOS Reference MPSS No.1 the performance showed a concentration 6% lower than the TROPOS Reference Instrument No.1. The original CPC from UBA-Schauinsland MPSS had technical problems and has to be repaired. The candidate should run with the T-CPC on the station until the MPSS-CPC is fixed. The candidate passed the standards of ACTRIS and GAW under the conditions, using the TROPOS Reference CPC No.1.

Laboratory Setup and Legend

Candidates
MPSS Schauinsland

Aerosol: Ambient

Flow: 15-20 l/min

RH: < 30% (dryer)

WCCAP - LAB
PSL-generator
Reference TCPC
Reference MPSS

Additional Equipment:
- Bubble flow meter 'Gilibrator', Gilian (Sensidyne)
- Thermo Scientific Nanosphere Size Standard PSL 203nm (±4nm)
- Aerosol nebulizer for PSL (homemade TROPOS)
- Voltcraft multimeter (0-1000V), Keysight Technologies

Legend for plots:
- MC = multiple charge correction
- DL = diffusion loss correction
- CE = CPC efficiency curve
- AL = additional loss corrections

Lab setup:

TROPOS Reference Instruments No. 1 and No. 4

### May 20 – May 21, 2019: Time Series, Particle Number Size Distribution and Correlation
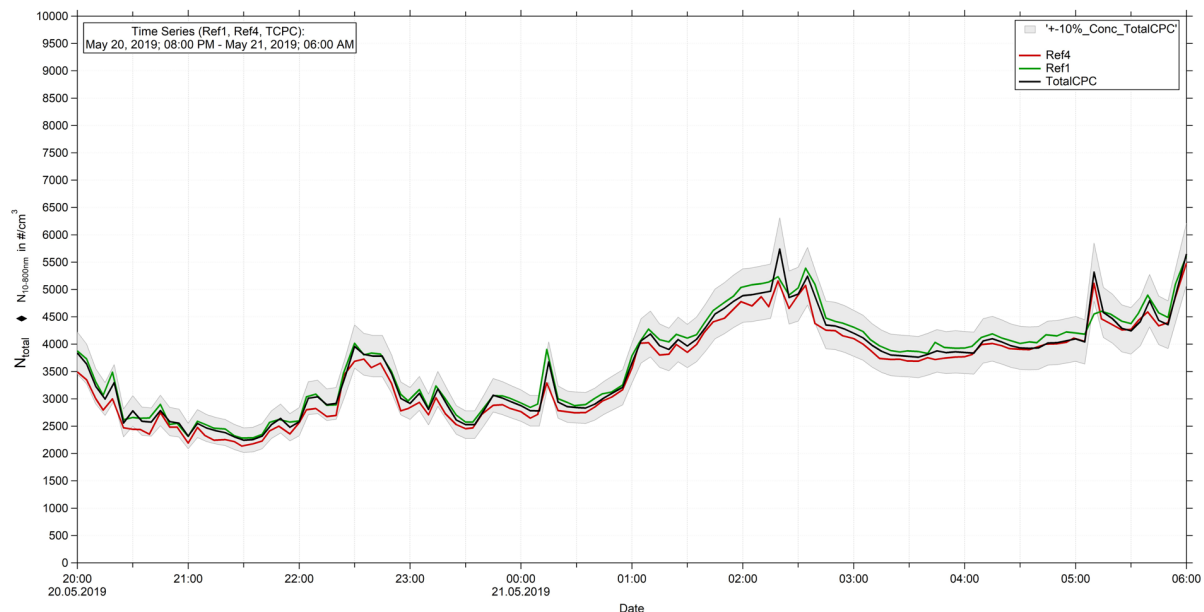
Figure 01: Time series (May 20, 2019 8 PM – May 21, 2019 6 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the TROPOS Reference MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.
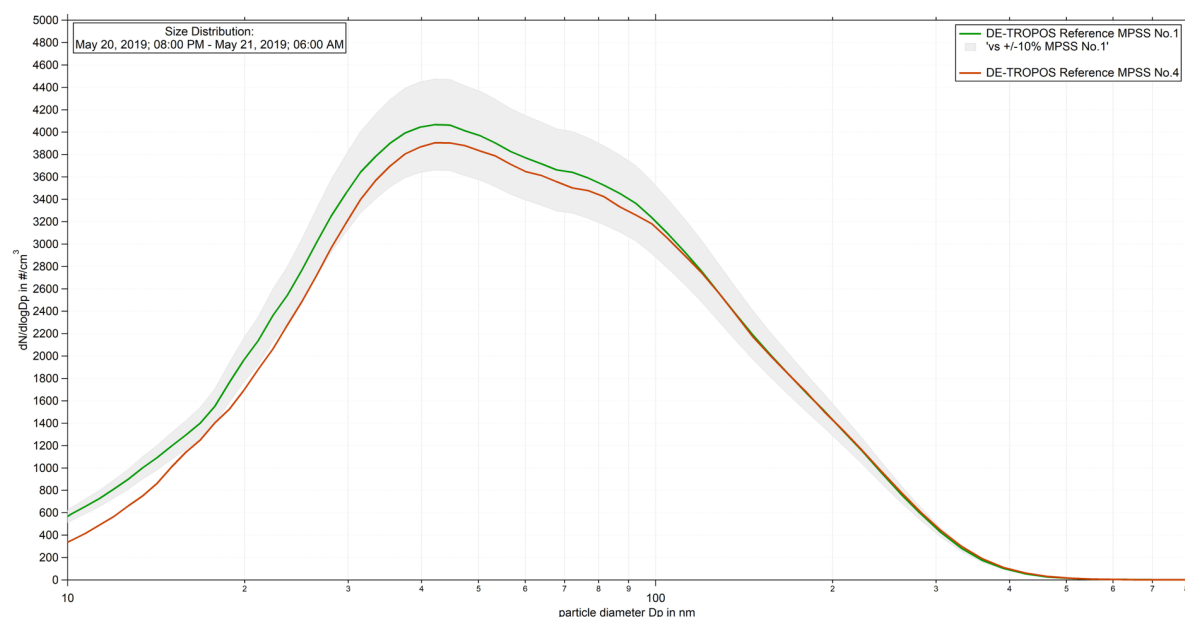
Figure 02: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against TROPOS Reference MPSS No.4 from May 20, 2019 8 PM – May 21, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.
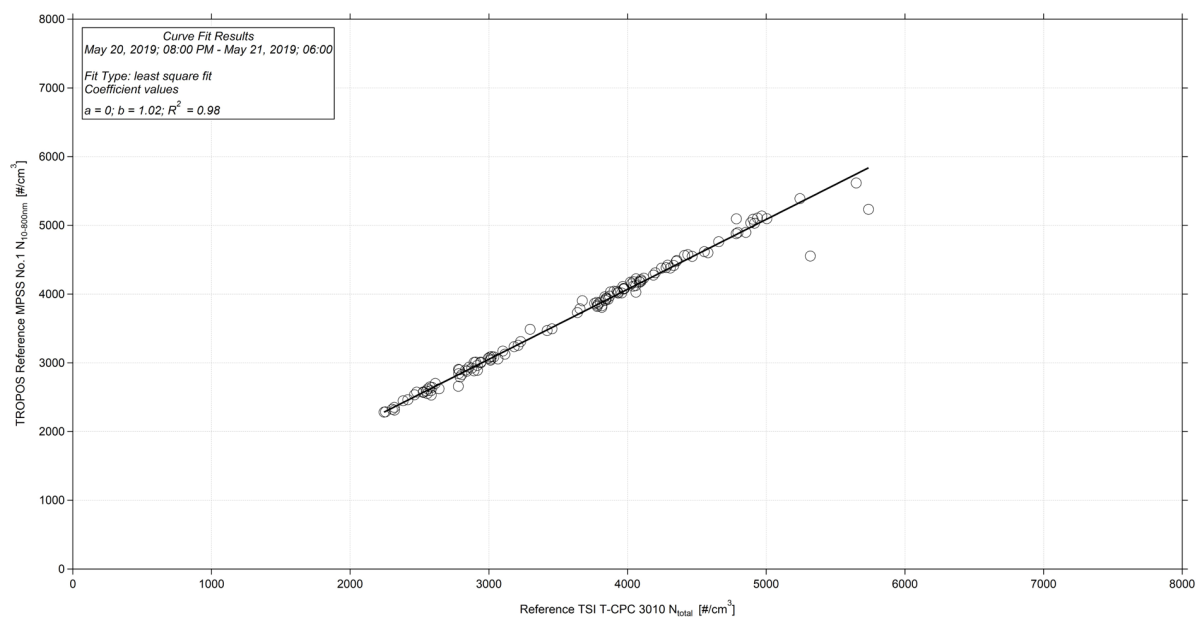
Figure 03: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
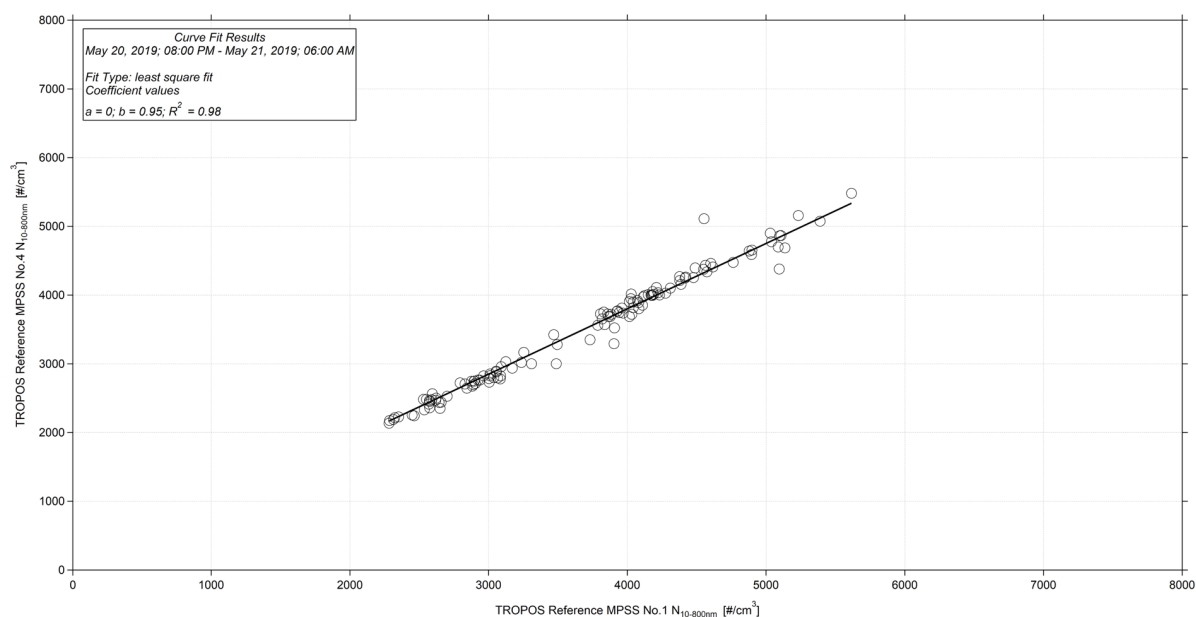

Figure 04: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference MPSS No.6. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

PSL Scan: Latex 203 nm +/- 4 nm

Date: May 20, 2019
Latex 203 nm +/- 4 nm
Peak at Dp = 202.42 nm

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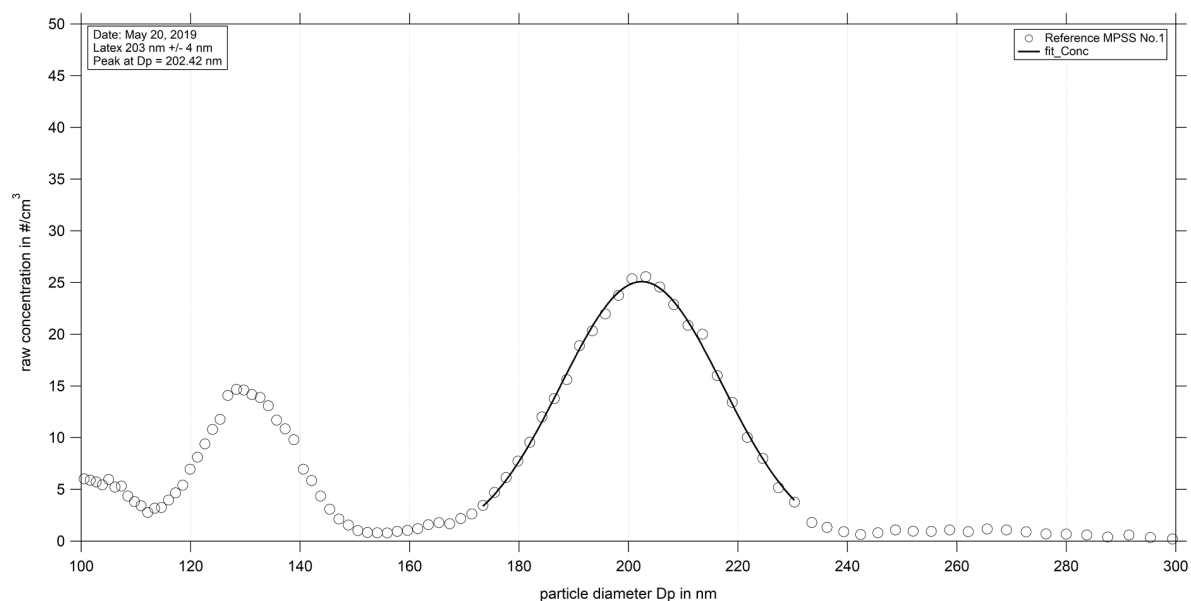
Figure 05: Measurement of latex 203 nm - Reference MPSS No.1: Particle size distribution (raw concentration) for latex 203 nm on May 20th 2019.

Date: May 20, 2019
Latex 203 nm +/- 4 nm
Peak at Dp = 202.22 nm

○ MPSS Schauinslad-UBA
— fit_Conc
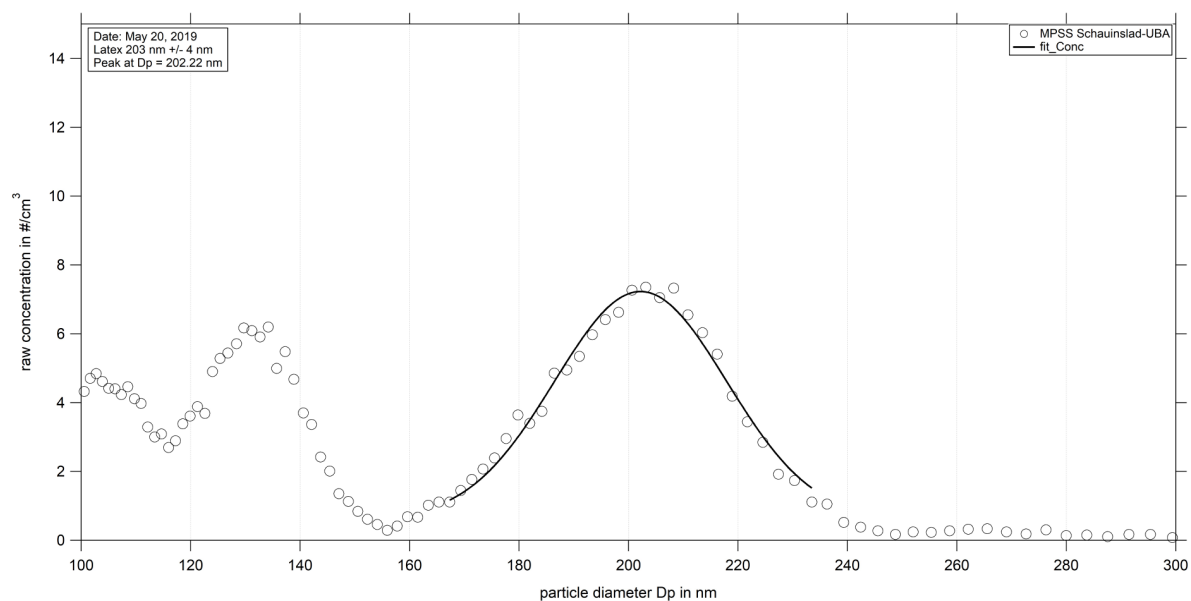
Figure 06: Measurement of latex 203 nm for the candidate UBA-Schauinsland MPSS: Particle size distribution for latex 203 nm on May 20th 2019 with a peak at 202.22 nm.
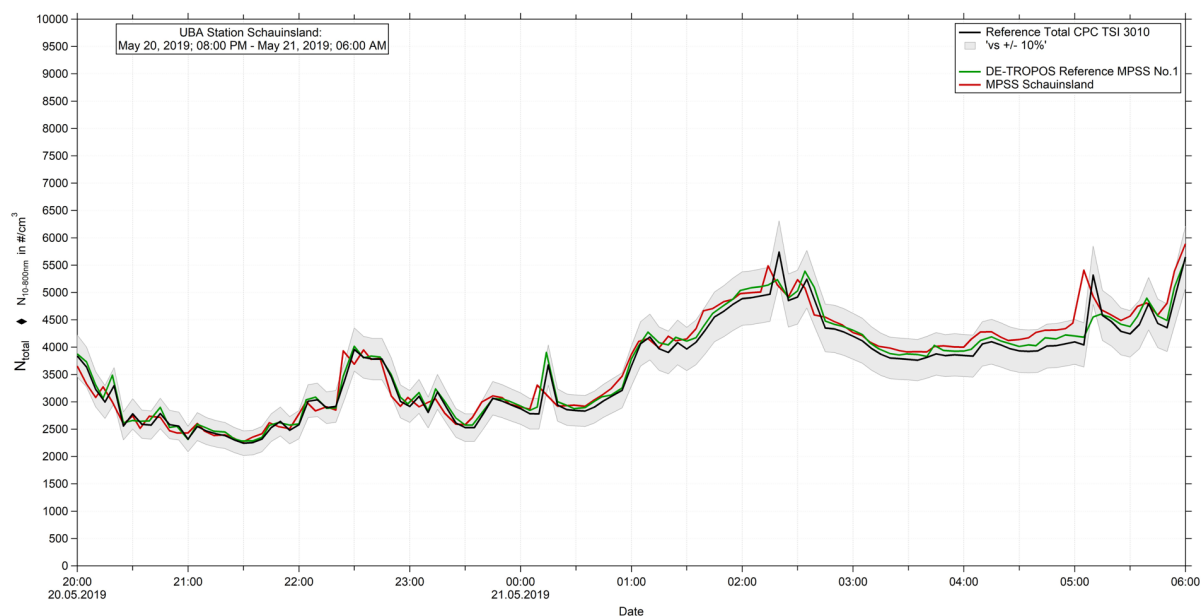
<div align="center">

Pre-Status October 20 – 21, 2019

Instrument Settings, Time Series, Particle Number Size Distribution and Correlation

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Table No. 1:

Institute: *Umweltbundesamt*							
Station: Schauinsland							
Date of checking list: *20.05.2019*							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	**TROPOS**			ST	**39.1**	OFF	
Firmware Classifier:	**TROPOS**			CT	**22.0**	5 V	**4.0**
Firmware Software:	**6.68**			OT	**40.1**	1000 V	**999.1**
DMA type:	**Vienna**		**162**	CabT	**27.3**	0 V	**0**
CPC model:	**TSI CPC 3772**	**70738095**		AP	**100.1**		
Firmware CPC:	**2.9**			OP	**65.5**	5 V	**5.1**
radioactive source:	**Kr-85**	**825/98**		NP	**2.7**	1000 V	**1000**
Aerosol Nafion Dryer	**-**	**-**		LC	**39**	250 V	**250.1**
Sheath Nafion Dryer		**ND0.7-49C**				5 V	**5.1**
Aerosol inlet dryer		**-**				0	**0**
Flow CPC (l/min):							
Flow Inlet (l/min):	**1.003**						
Flow Display (l/min):							
Zero (#/cm^3):							
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:	**System Running over night without a 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 ($N_{10-800nm}$ or $N_{10.6-500nm}$) 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.
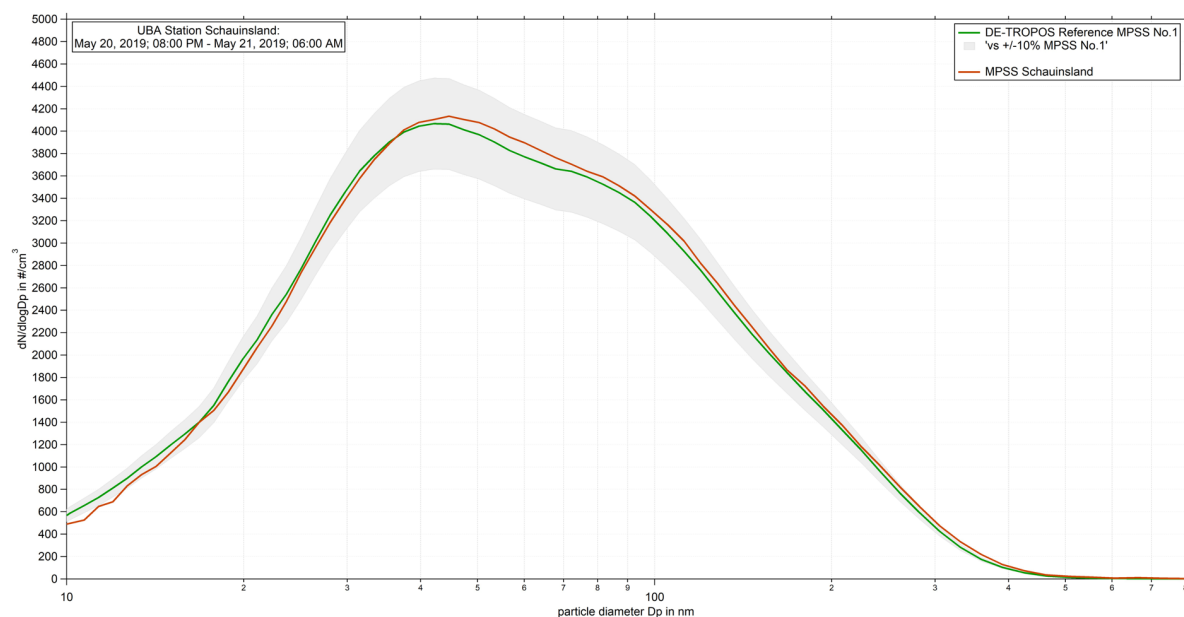
Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Schauinsland MPSS from May 20, 2019 8 PM –May 21, 2019 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.
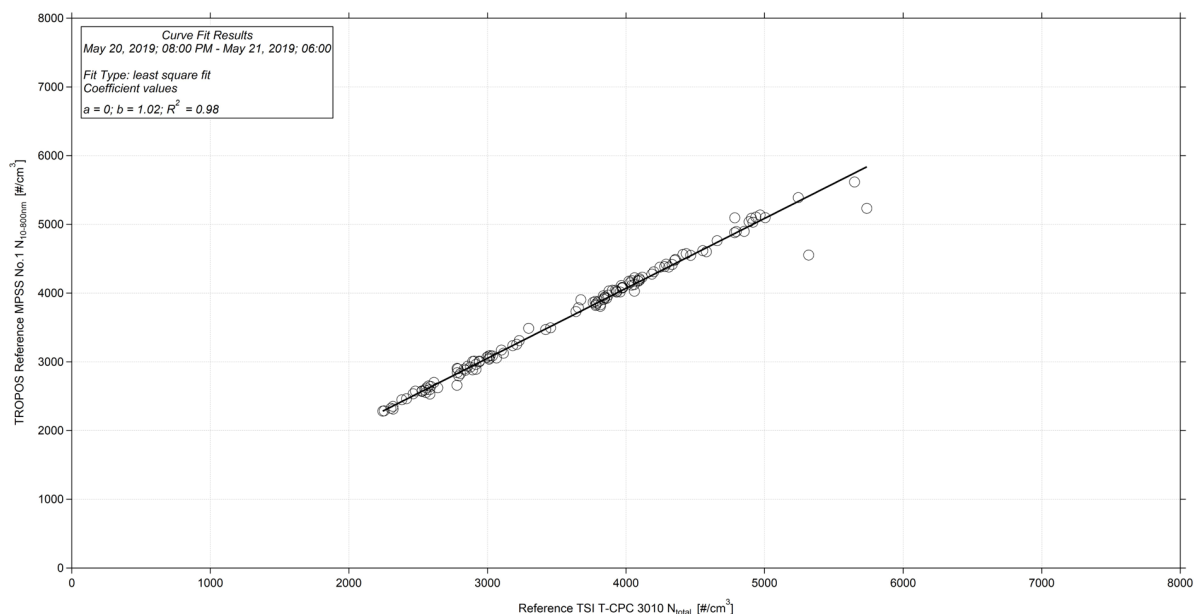
Figure 10: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
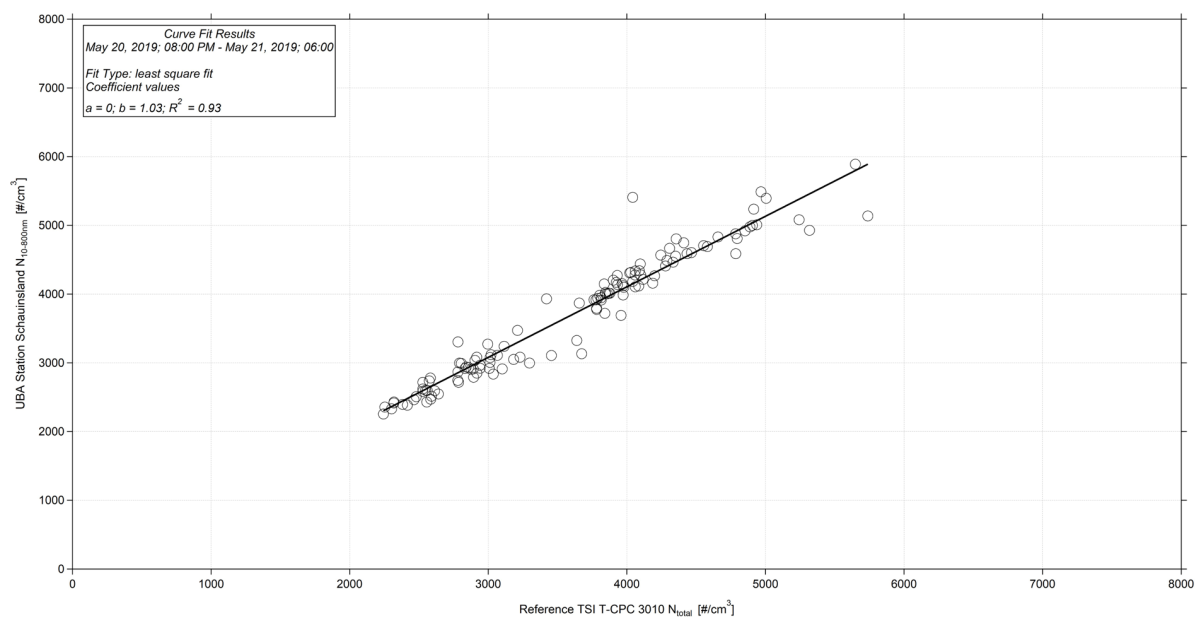
Figure 11: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and UBA-Schauinsland MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
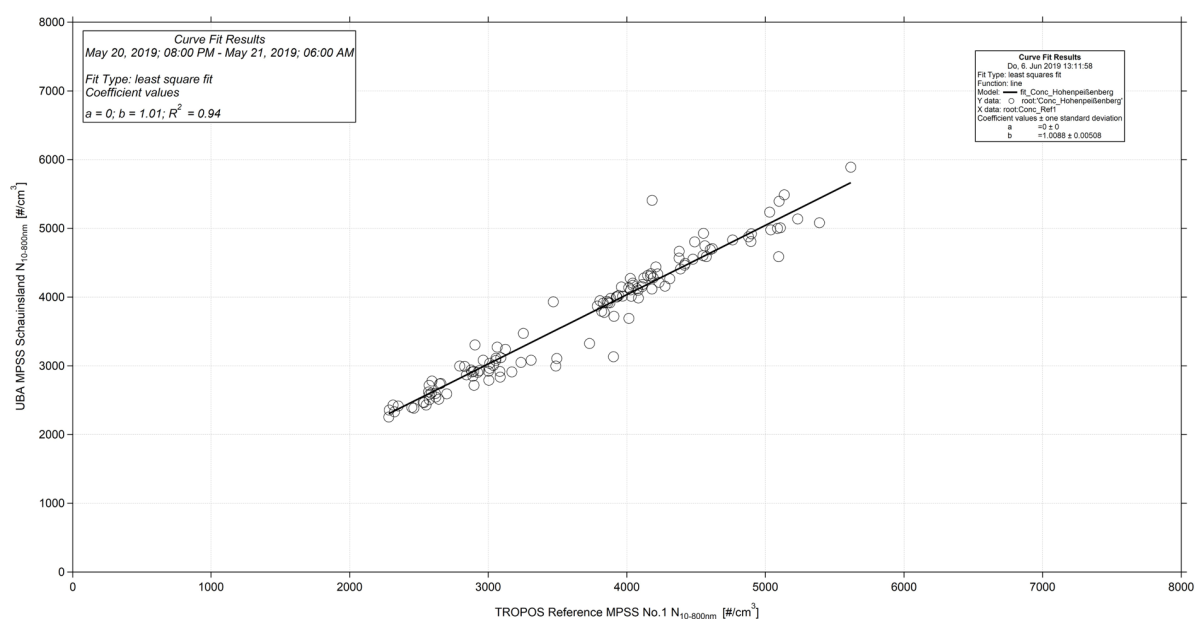
Figure 12: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-HLNUG MPSS_001 Schwanheim. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
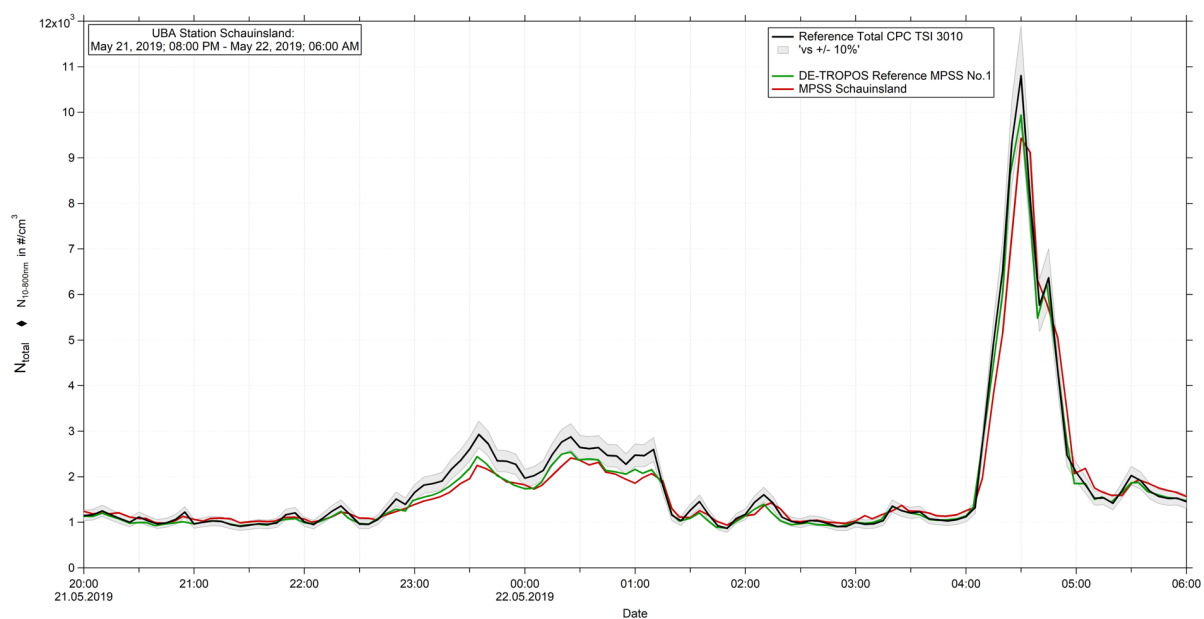
Status May 21 – 22, 2018

Instrument Settings, Time Series, Particle Number Size Distribution and Correlation

Table No. 2:

Institute: *Umweltbundesamt*							
Station: Schauinsland							
Date of checking list: **21.05.2019**							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	**TROPOS**			ST	**39.1**	*OFF*	
Firmware Classifier:	**TROPOS**			CT	**22.0**	*5 V*	**4.0**
Firmware Software:	**6.68**			OT	**40.1**	*1000 V*	**999.1**
DMA type:	**Vienna**		**162**	CabT	**27.3**	*0 V*	**0**
CPC model:	**TSI CPC 3772**	**70738095**		AP	**100.1**		
Firmware CPC:	**2.9**			OP	**65.5**	*5 V*	**5.1**
radioactive source:	**Kr-85**	**825/98**		NP	**2.7**	*1000 V*	**1000**
Aerosol Nafion Dryer	**-**	**-**		LC	**39**	*250 V*	**250.1**
Sheath Nafion Dryer		**ND0.7-49C**				*5 V*	**5.1**
Aerosol inlet dryer		**-**				*0*	**0**
Flow CPC (l/min):							
Flow Inlet (l/min):	**1.003**						
Flow Display (l/min):							
Zero (#/cm³):							
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:	**System running over night without a 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 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 (#/cm³):	**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 (#/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 ($N_{10-800nm}$ or $N_{10.6-500nm}$) 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.
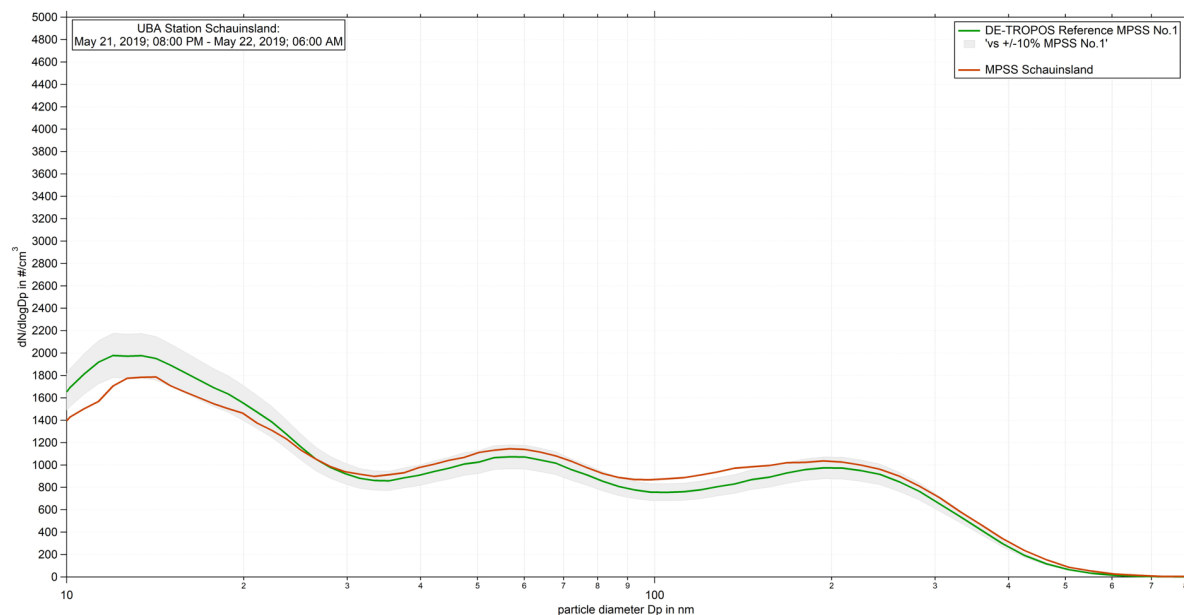
Figure 14: Comparison of median particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Schauinsland MPSS from May 21, 2019 8 PM – May 22, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.
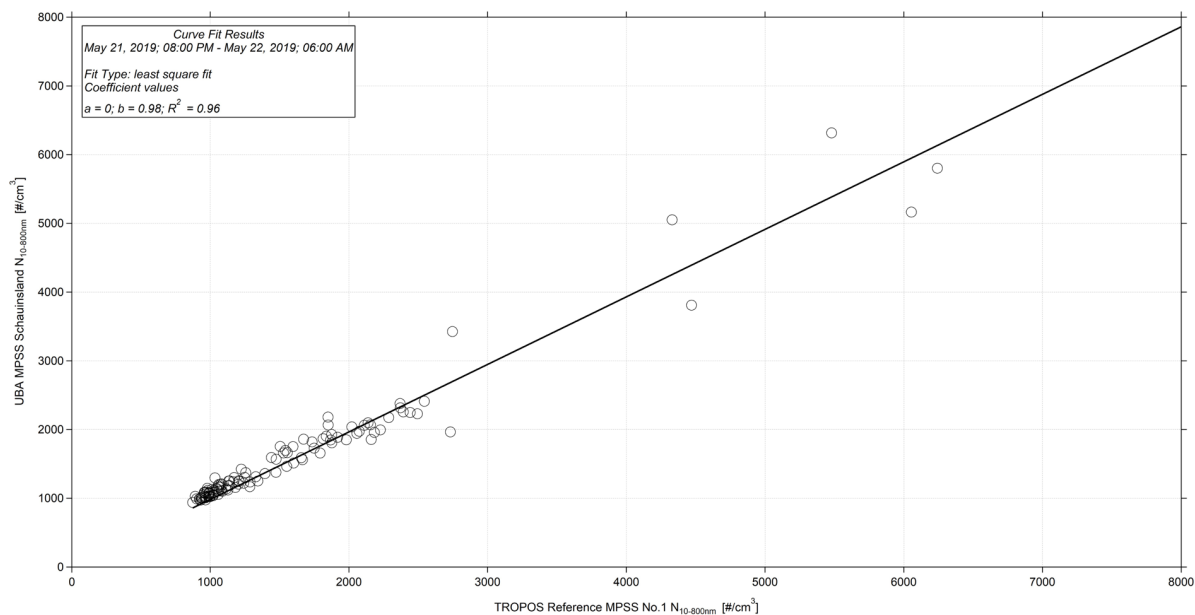
Figure 15: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Schauinsland MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
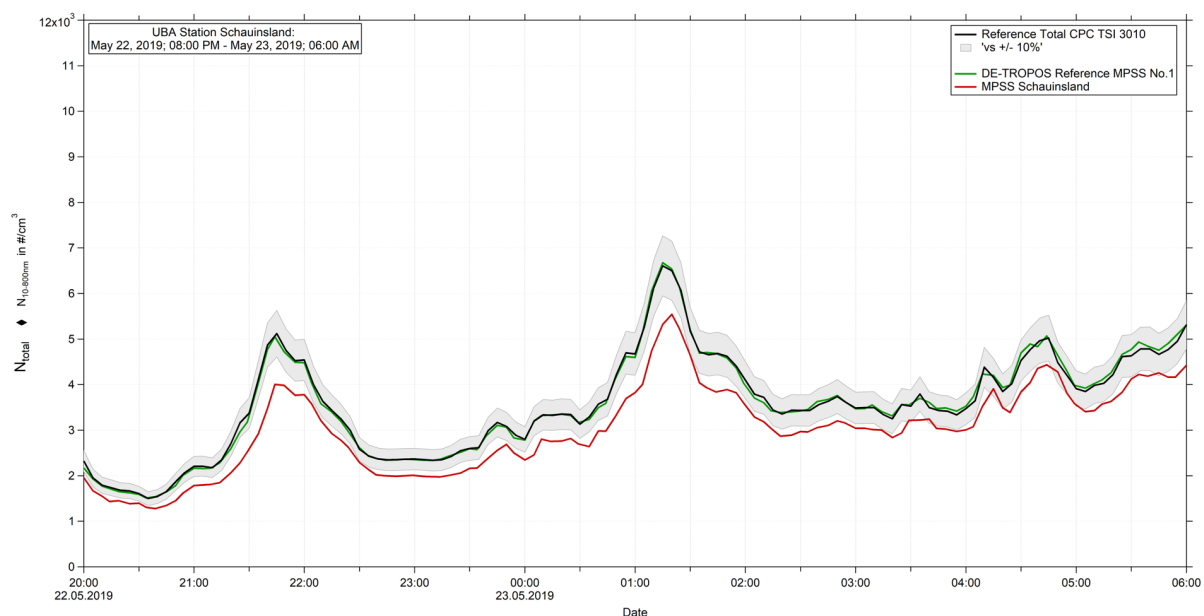
Status May 22 – 23, 2019

Instrument Settings, Time Series, Particle Number Size Distribution and Correlation

Table No. 2:

Institute: **Umweltbundesamt**							
Station: Schauinsland							
Date of checking list: **22.05.2019**							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	**TROPOS**			ST	**39.1**	OFF	
Firmware Classifier:	**TROPOS**			CT	**22.0**	5 V	5
Firmware Software:	**6.68**			OT	**40.1**	1000 V	999.9
DMA type:	**Vienna**		162	CabT	**27.3**	0 V	0
CPC model:	**TSI CPC 3772**	**70738095**		AP	**100.1**		
Firmware CPC:	**2.9**			OP	**65.5**	5 V	5.0
radioactive source:	**Kr-85**	**825/98**		NP	**2.7**	1000 V	999.9
Aerosol Nafion Dryer	**-**	**-**		LC	**39**	250 V	249.9
Sheath Nafion Dryer		**ND0.7-49C**				5 V	5.0
Aerosol inlet dryer		**-**				0	0.1
Flow CPC (l/min):							
Flow Inlet (l/min):	**0.979**						
Flow Display (l/min):							
Zero (#/cm³):							
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:		**System without nafion**					
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:							
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:		**Change CPC from SN 70738095 to SN 3772164005**					
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 (#/cm³):	**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 (#/cm³):	**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 ($N_{10-800nm}$ or $N_{10.6-500nm}$) 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 MPSS System was running with a TSI CPC 3772 SN3772164005
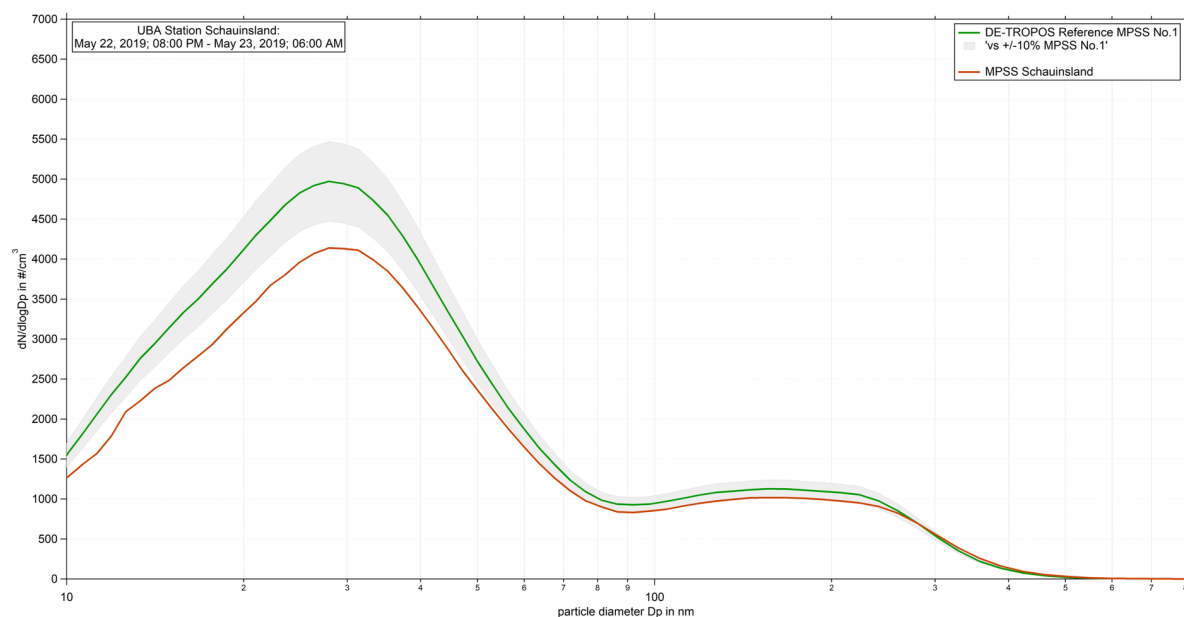
Figure 17: Comparison of median particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Schauinsland MPSS from May 22, 2019 8 PM – May 23, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.
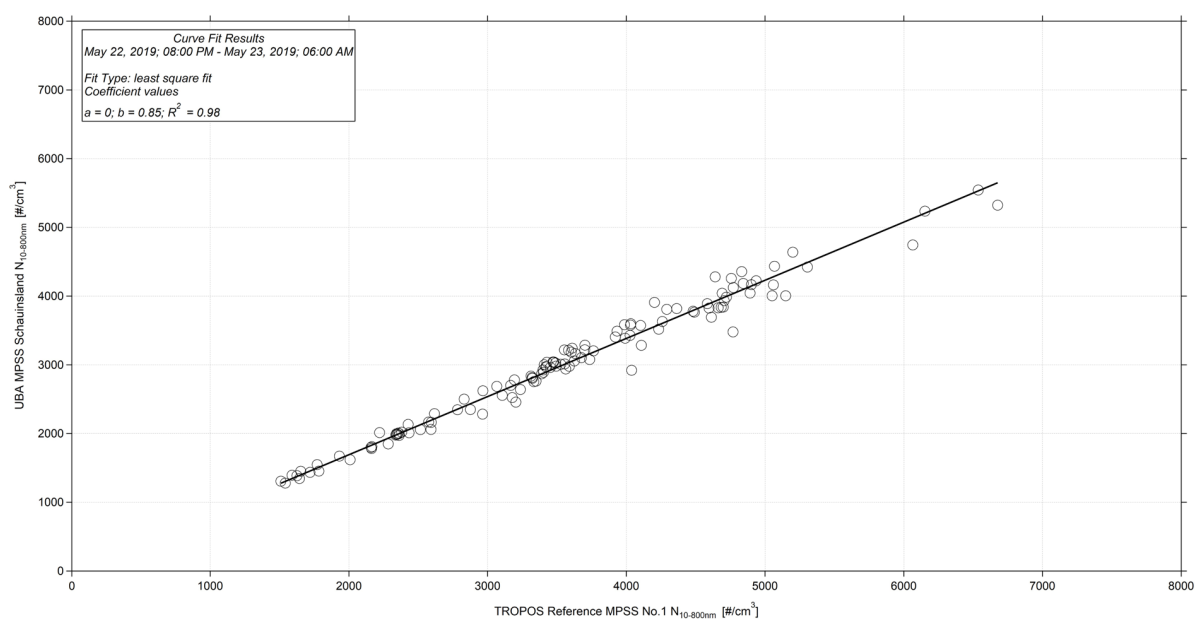
Figure 18: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Schauinsland MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
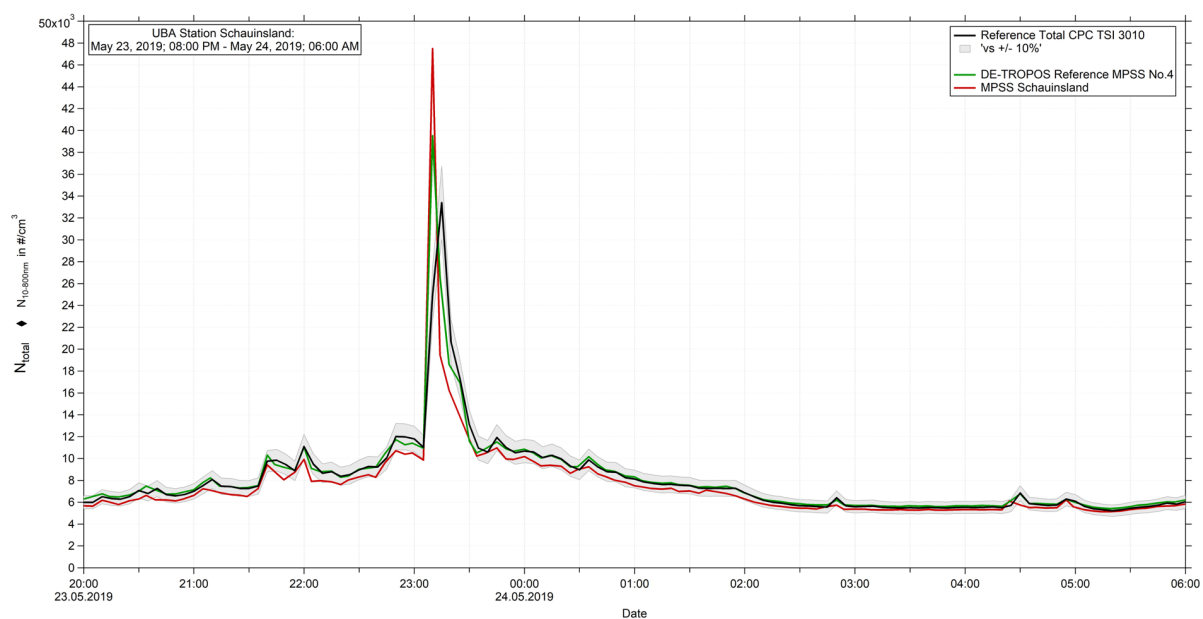
Status May 23-24.05.2019

Instrument Settings, Time Series, Particle Number Size Distribution and Correlation

Table No. 3:

Institute: **Umweltbundesamt**							
Station: Schauinsland							
Date of checking list: **23.05.2019**							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	**TROPOS**			ST		OFF	
Firmware Classifier:	**TROPOS**			CT		5 V	
Firmware Software:	**6.68**			OT		10 V	
DMA type:	**Vienna**			CabT		1000 V	
CPC model:	**TSI CPC 3772**			AP		250 V	
Firmware CPC:	**2.9**			OP		5 V	
radioactive source:	**Kr-85**			NP		400 V	
Flow CPC (l/min):	**-**			LC		600 V	
Flow Inlet (l/min):	**0.971**					800 V	
Flow Display (l/min):						700 V	
Zero (#/cm³):						650 V	
			Maintenance				
Aerosol inlet:							
Aerosol Nafion dryer:			**System without nafion**				
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:			**DMA changed from 162 to 161**				
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:			**TCPC running instead of MPSS CPC**				
Impactor:							
Setup settings over night:							

Institute: **TROPOS**							
Station: **Reference Instrument No.1**							
Date of checking list: **23.05.2019**							
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 (#/cm³):	**0**						

Institute: **TROPOS**						
Station: **Reference Total CPC**						
Date of checking list: **23.05.2019**						
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 (#/cm³):	**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 ($N_{10-800nm}$ or $N_{10.6-500nm}$) 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.
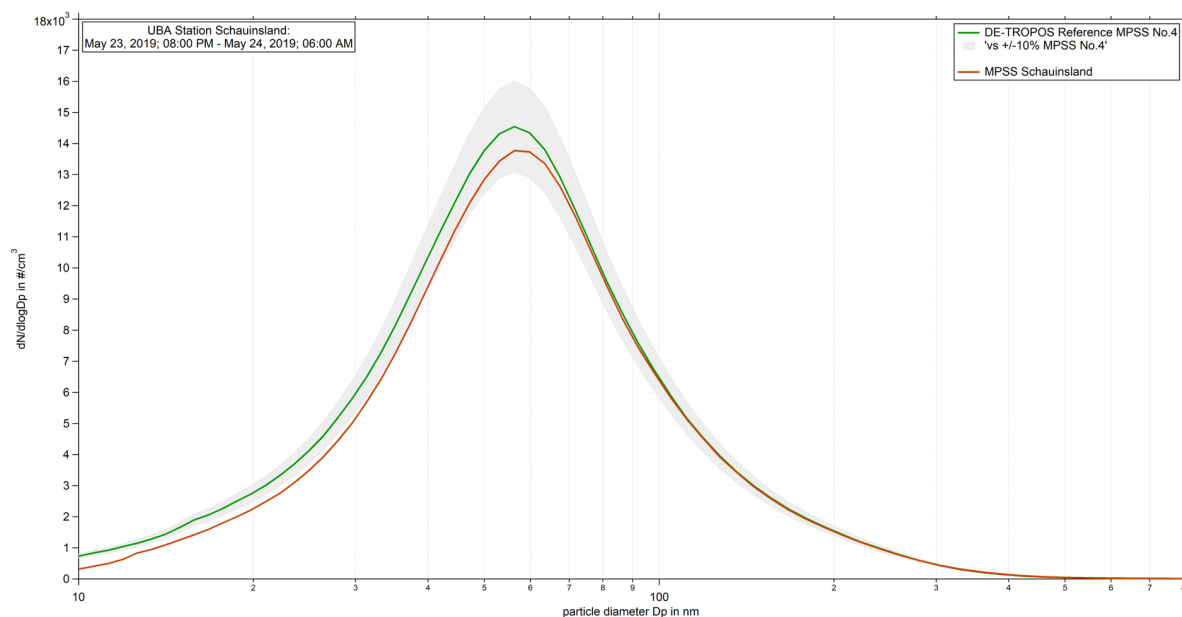
Figure 20: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Schauinsland MPSS from May 23, 2019 8 PM – May 24, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.
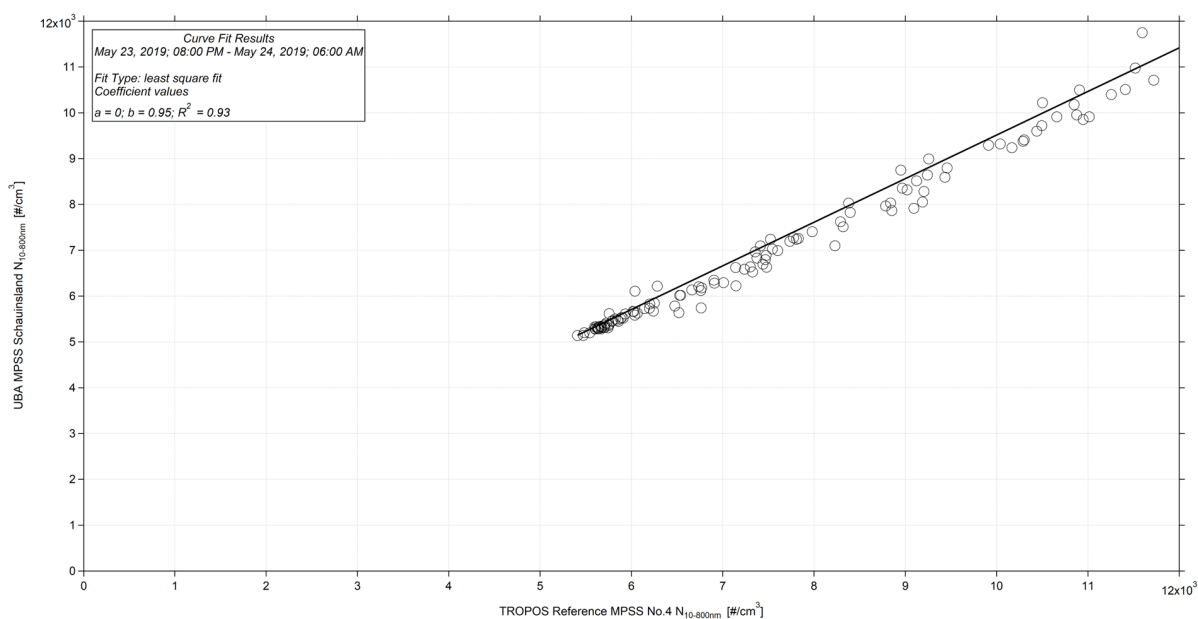
Figure 21: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and UBA-Schauinsland MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
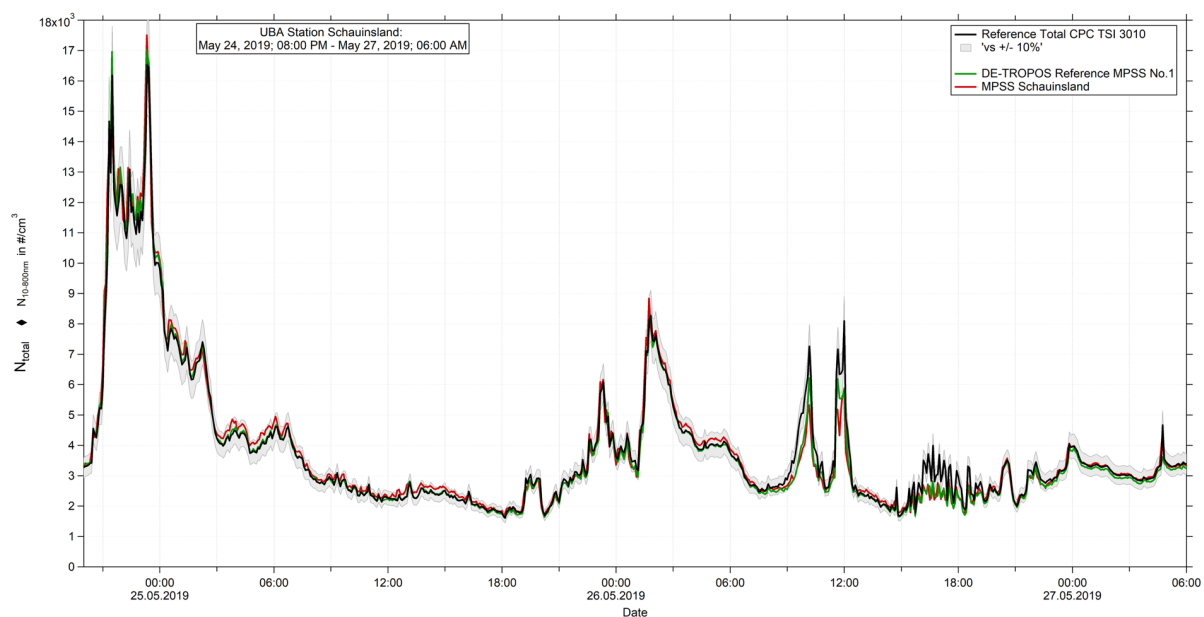
Status May 24-27.05.2019

Instrument Settings, Time Series, Particle Number Size Distribution and Correlation

Table No. 4:

Institute: *Umweltbundesamt*							
Station: Schauinsland							
Date of checking list: *24.05.2019*							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	**TROPOS**			ST		OFF	
Firmware Classifier:	**TROPOS**			CT		5 V	
Firmware Software:	**6.68**			OT		10 V	
DMA type:	**Vienna**			CabT		1000 V	
CPC model:	**TSI CPC 3772**			AP		250 V	
Firmware CPC:	**2.9**			OP		5 V	
radioactive source:	**Kr-85**			NP		400 V	
Flow CPC (l/min):	**-**			LC		600 V	
Flow Inlet (l/min):	**0.971**					800 V	
Flow Display (l/min):						700 V	
Zero (#/cm³):						650 V	
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:		**System without nafion**					
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:		**DMA changed from 162 to 161**					
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:		**TCPC running instead of MPSS CPC**					
Impactor:							
Setup settings over night:							

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 (#/cm³):	**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 (#/cm³):	**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 ($N_{10-800nm}$ or $N_{10.6-500nm}$) 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.
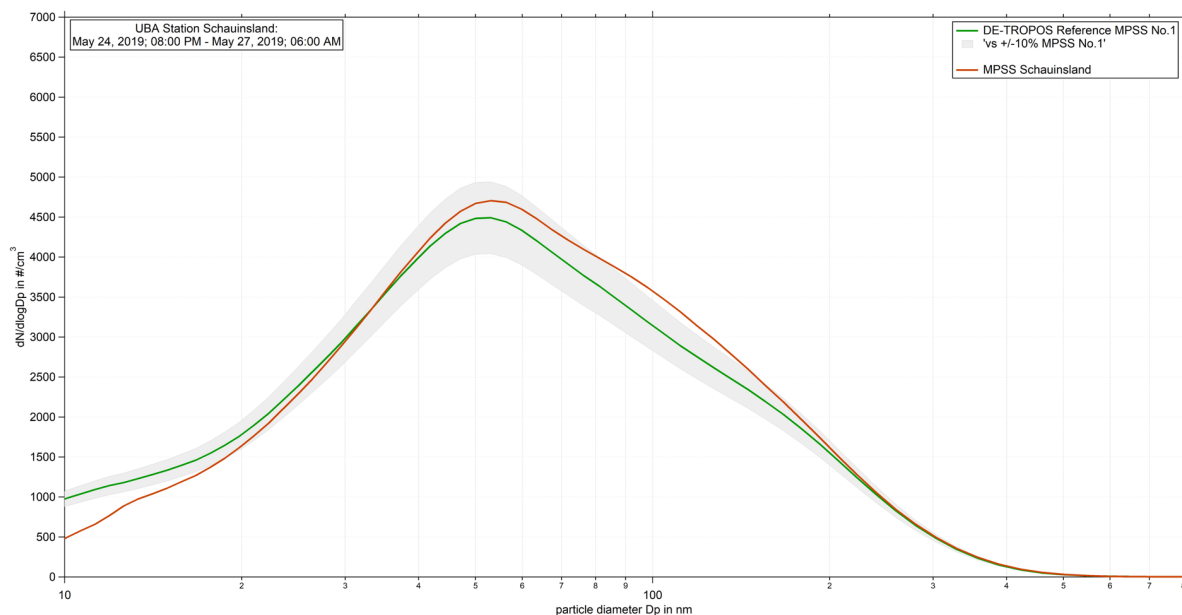
Figure 23: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Schauinsland MPSS from May 24, 2019 8 PM – May 27, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.
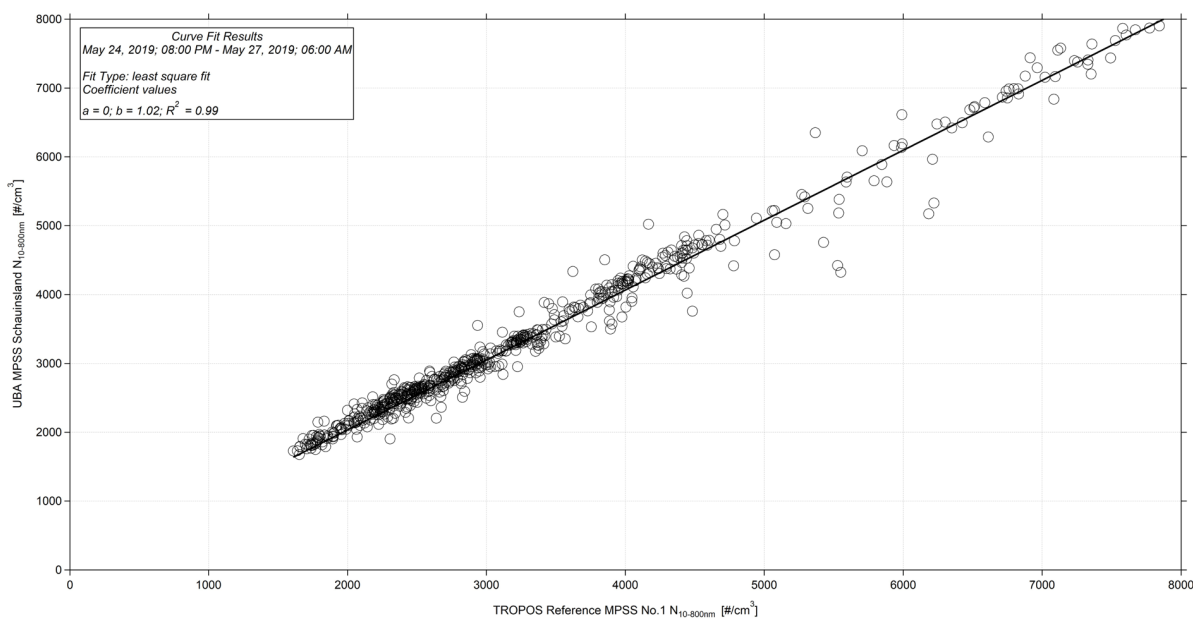
Figure 24: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Schauinsland MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
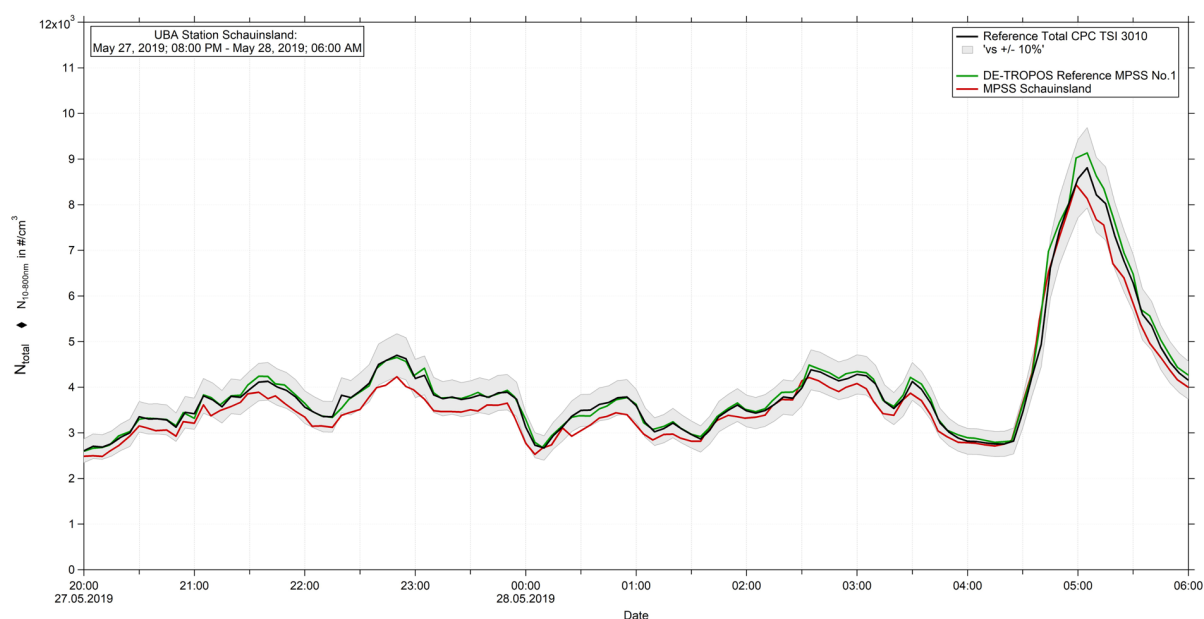
Status May 27-28.05.2019

Instrument Settings, Time Series, Particle Number Size Distribution and Correlation

Table No. 4:

Institute: **Umweltbundesamt**							
Station: Schauinsland							
Date of checking list: **27.05.2019**							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	**TROPOS**			ST		OFF	
Firmware Classifier:	**TROPOS**			CT		5 V	
Firmware Software:	**6.68**			OT		10 V	
DMA type:	**Vienna**			CabT		1000 V	
CPC model:	**TSI CPC 3772**			AP		250 V	
Firmware CPC:	**2.9**			OP		5 V	
radioactive source:	**Kr-85**			NP		400 V	
Flow CPC (l/min):	**-**			LC		600 V	
Flow Inlet (l/min):	**0.971**					800 V	
Flow Display (l/min):						700 V	
Zero (#/cm³):						650 V	
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:		**System without nafion**					
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:		**DMA changed from 162 to 161**					
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:		**TCPC running instead of MPSS CPC**					
Impactor:							
Setup settings over night:							

Institute: **TROPOS**							
Station: **Reference Instrument No.1**							
Date of checking list: **27.05.2019**							
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 (#/cm³):	**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 (#/cm³):	**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 ($N_{10\text{-}800nm}$ or $N_{10.6\text{-}500nm}$) 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.
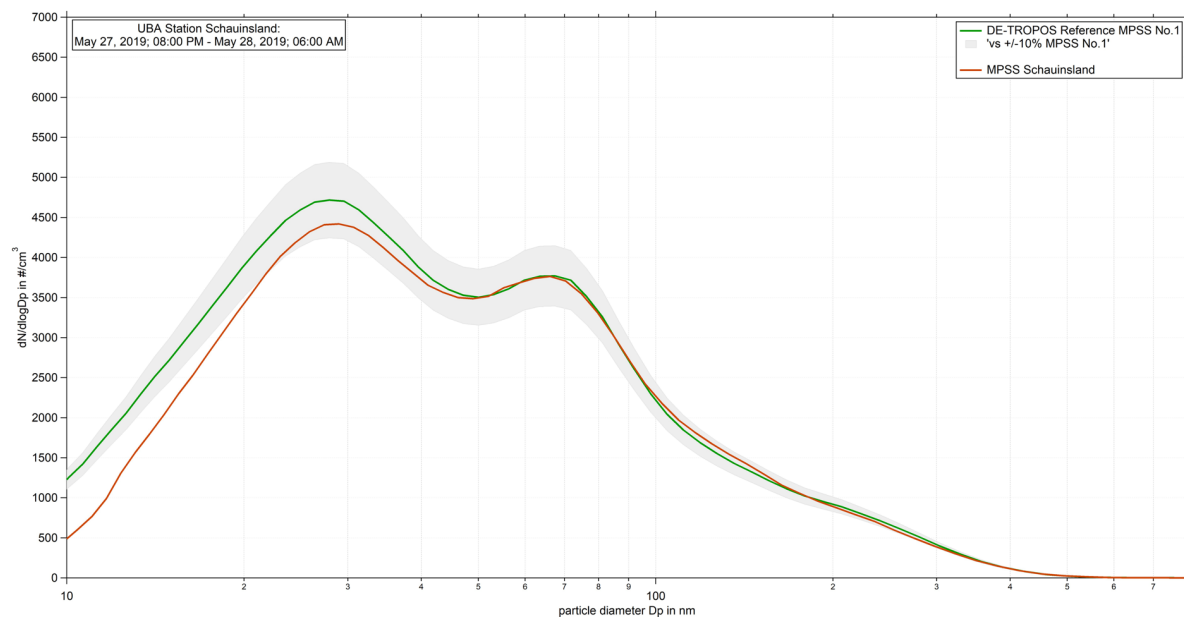
Figure 26: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Schauinsland MPSS from May 27, 2019 8 PM – May 28, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.
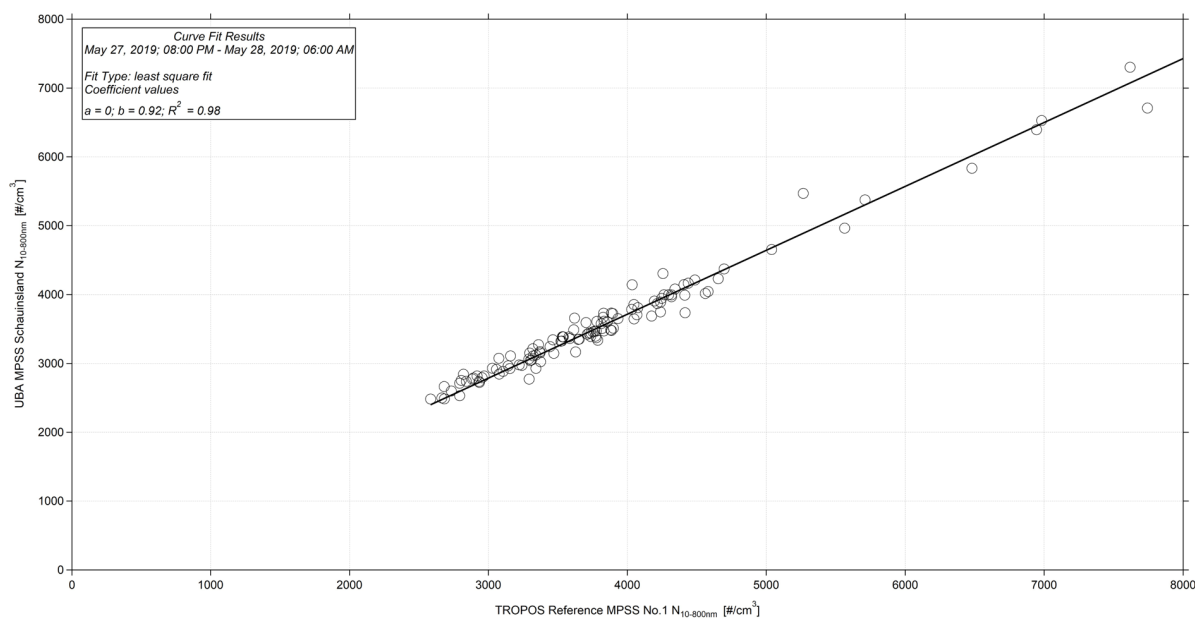
Figure 27: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Schauinsland MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final Status May 28-29.05.2019

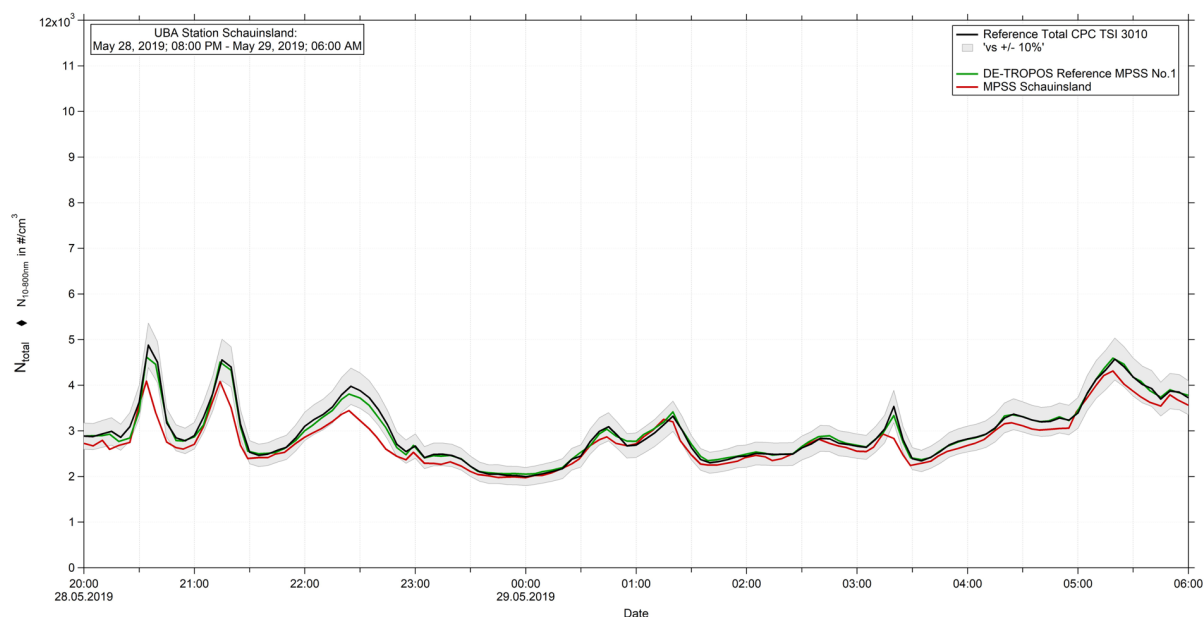### Instrument Settings, Time Series, Particle Number Size Distribution and Correlation

Table No. 4:

Institute: *Umweltbundesamt*							
Station: Schauinsland							
Date of checking list: 28.05.2019							
Instrument/ Components	*info*	*SN*	*Date/Code*	*CPC-Status*		*HV-Status*	
MPSS/Classifier:	**TROPOS**			*ST*		*OFF*	
Firmware Classifier:	**TROPOS**			*CT*		*5 V*	
Firmware Software:	**6.68**			*OT*		*10 V*	
DMA type:	**Vienna**			*CabT*		*1000 V*	
CPC model:	**TSI CPC 3772**			*AP*		*250 V*	
Firmware CPC:	**2.9**			*OP*		*5 V*	
radioactive source:	**Kr-85**			*NP*		*400 V*	
Flow CPC (l/min):	**-**			*LC*		*600 V*	
Flow Inlet (l/min):	**0.971**					*800 V*	
Flow Display (l/min):						*700 V*	
Zero (#/cm³):						*650 V*	
Maintenance							
Aerosol inlet:							
Aerosol Nafion dryer:		**System without nafion**					
Sheath Nafion dryer:							
Source:							
HV power supply:							
DMA:		**DMA changed from 162 to 161**					
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:		**TCPC running instead of MPSS CPC**					
Impactor:							
Setup settings over night:							

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 (#/cm³):	**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 (#/cm³):	**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 ($N_{10\text{-}800nm}$ or $N_{10.6\text{-}500nm}$) 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.
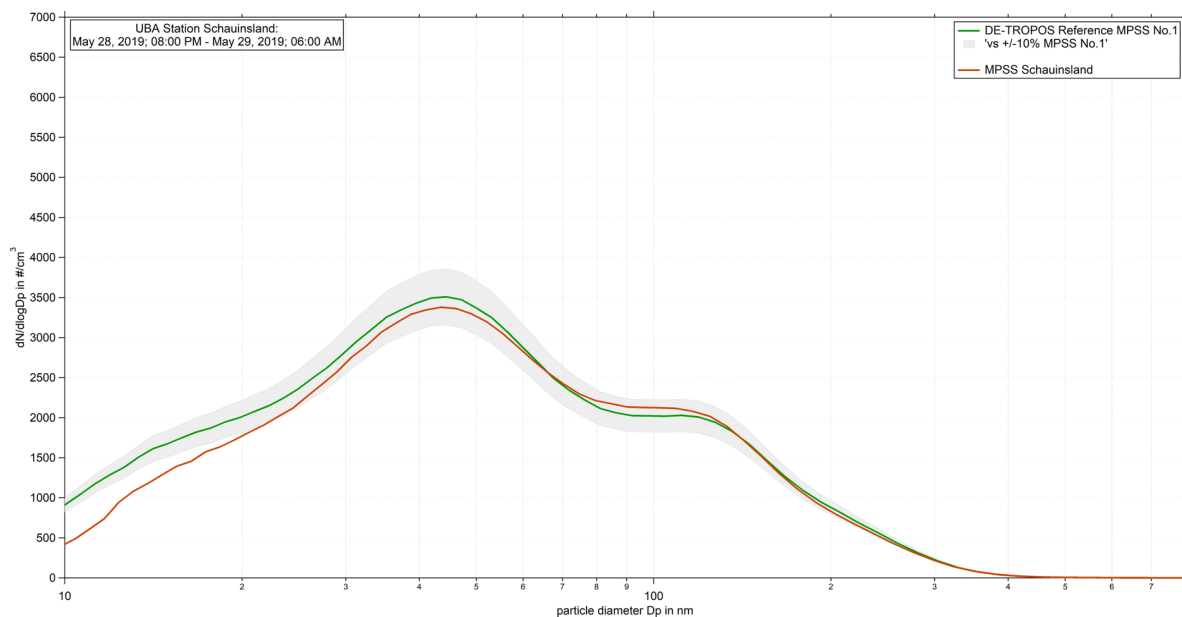
Figure 29: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against UBA-Schauinsland MPSS from May 28, 2019 8 PM – May 29, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.
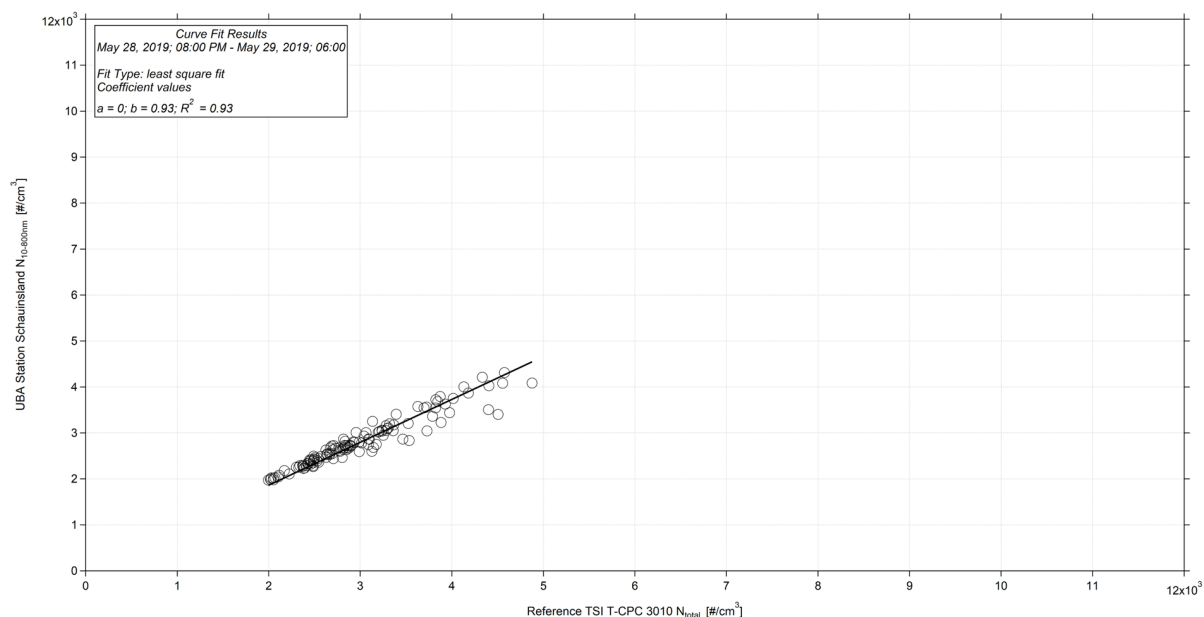
Figure 30: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and UBA-Schauinsland MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
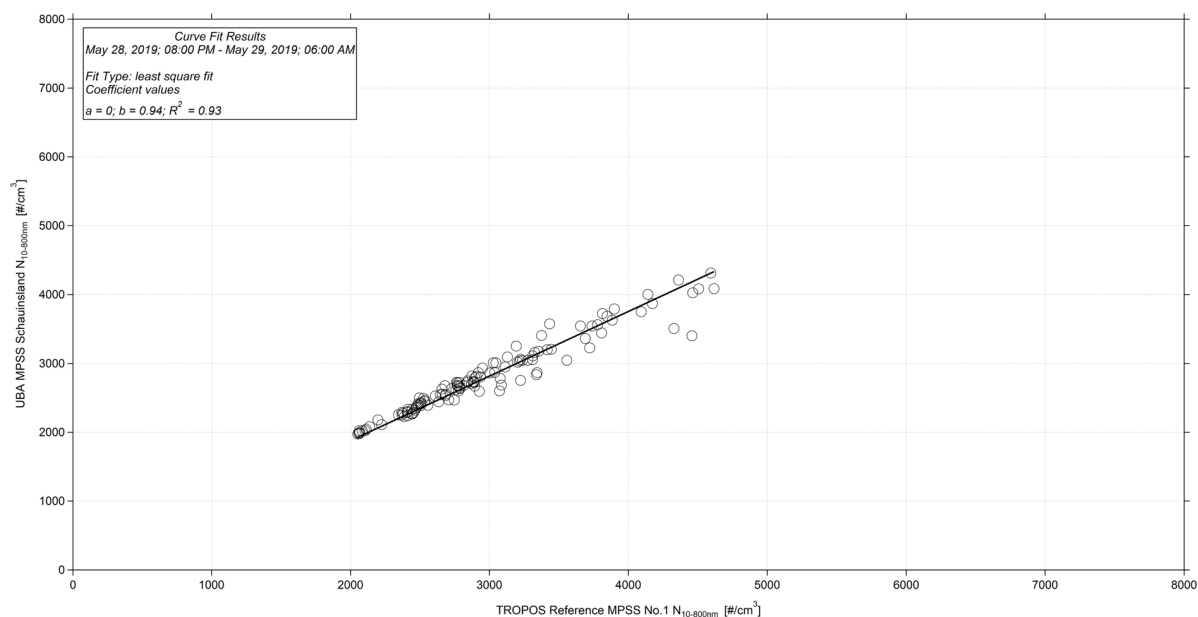
Figure 31: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and UBA-Schauinsland MPSS. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
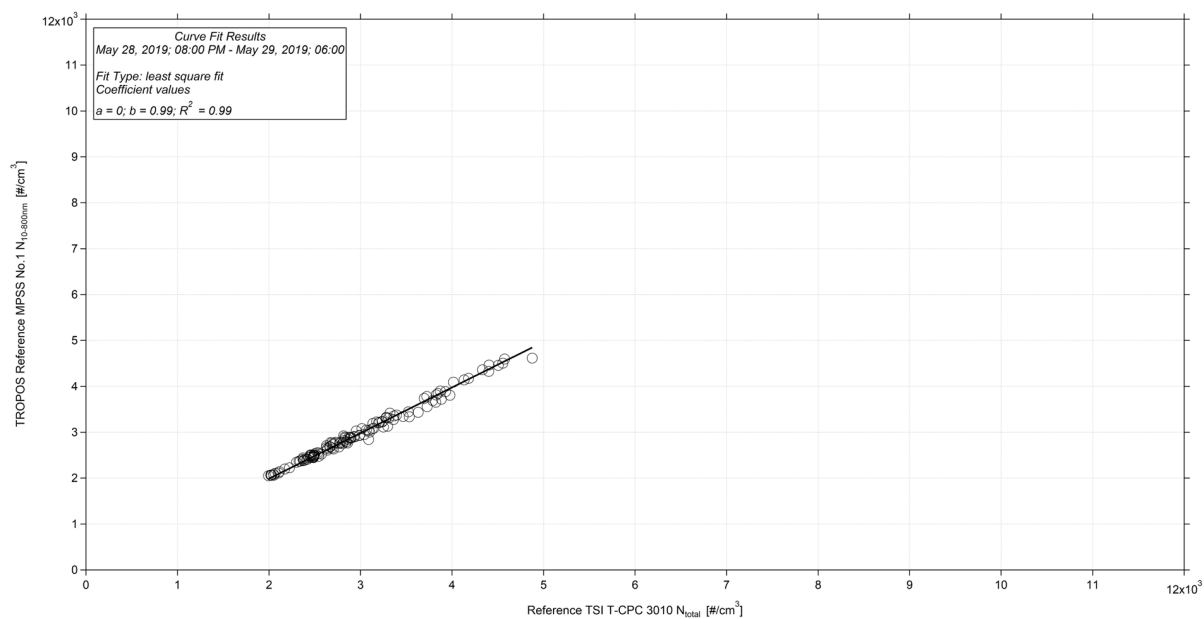
Figure 32: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TSI T-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC efficiency are included.