

Intercomparison of Mobility Particle Size Spectrometers

Project No.: MPSS-2018-7-1

Principal Investigator: Dr. Diana Rose

Home Institution: Hessisches Landesamt für Naturschutz, Umwelt und Geologie
Dezernat I2 Luftreinhaltung: Immissionen

Participant: Dr. Diana Rose

Candidate: DE-HLNUG MPSS 001 - Schwanheim

Made by: TSI – EC 3082

Counter (SN): CPC 3772 SN3772163801

Location of the quality assurance: TROPOS Leipzig, lab 118

Comparison period: October 15, 2018 – October 19, 2018

Last Intercomparison (with Project No.):

Summary of Intercomparison:

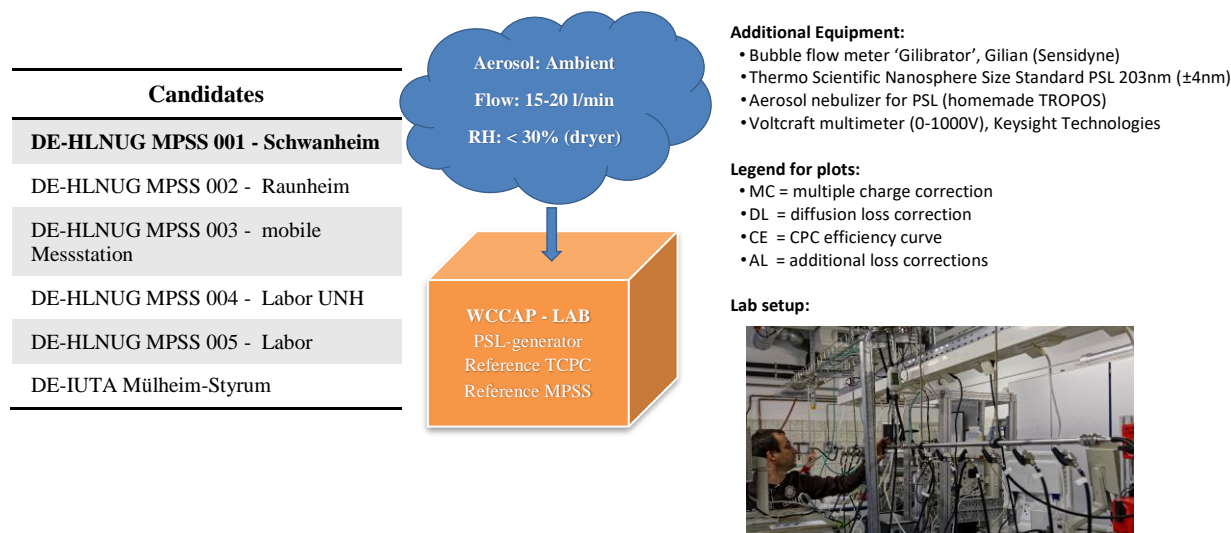
Pre-Status:

The candidate from DE-HLNUG MPSS_001 Schwanheim participated in the ACTRIS workshop from October 15, 2018 to October 19, 2018 with the participant. The setup of the candidate was done on Monday, October 15th, 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 10% lower than the TROPOS Reference Instrument No.1. On Tuesday, October 16th, after the CPC-Workshop the MPSS was checked and the first part of maintenance was done. The performance of the CPC is shown in the Report of the CPC-Workshop. The TSI CPC 3772 passed the CPC Workshop after maintenance. 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 October 18 to October 19, 2018. Running the candidate using the original source Kr.85 and the TROPOS Reference CPC No.6 the performance showed a concentration 1% lower than the TROPOS Reference Instrument No.1.. The original CPC from DE-HLNUG MPSS_001 Schwanheim had technical problems they can't solve. TROPOS recommend HLNUG to send the TSI CPC 3772 back to TSI for maintenance. The candidate passed the standards of ACTRIS and GAW under the conditions, using the TROPOS Reference CPC No.6.

Laboratory Setup and Legend



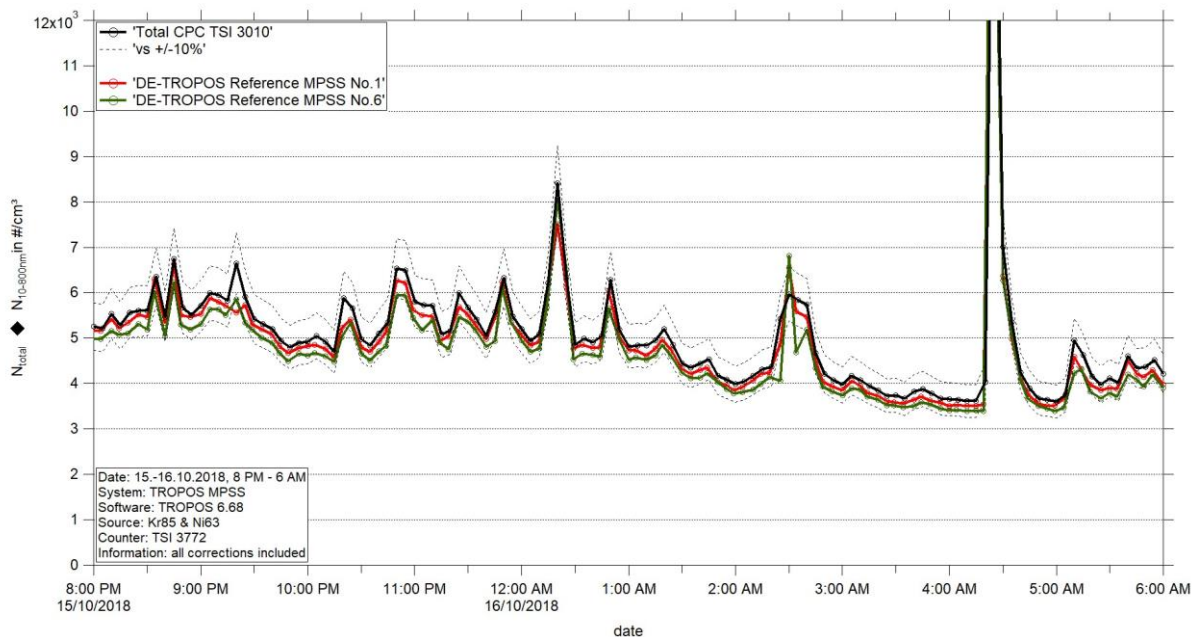
TROPOS Reference Instruments No. 1 and No. 6**October 15 – October 16, 2018: Time Series, Particle Number Size Distribution and Correlation**

Figure 01: Time series (October 15, 2018 8 PM – October 16, 2018 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.

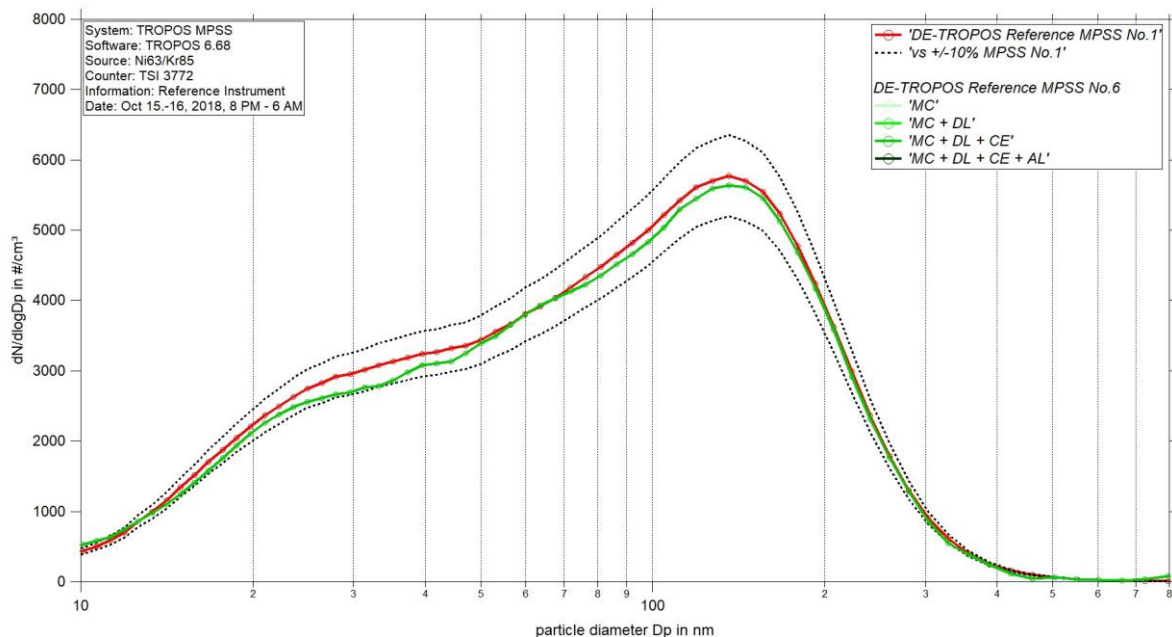


Figure 02: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against TROPOS Reference MPSS No.6 from October 15, 2018 8 PM – October 16, 2018 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

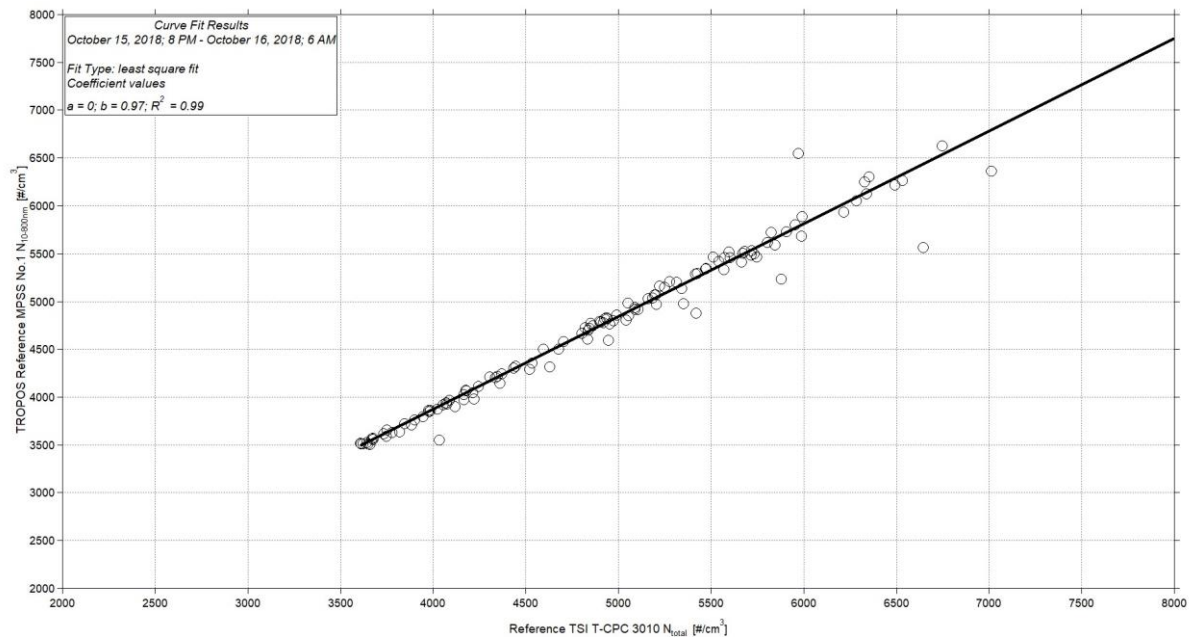


Figure 03: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

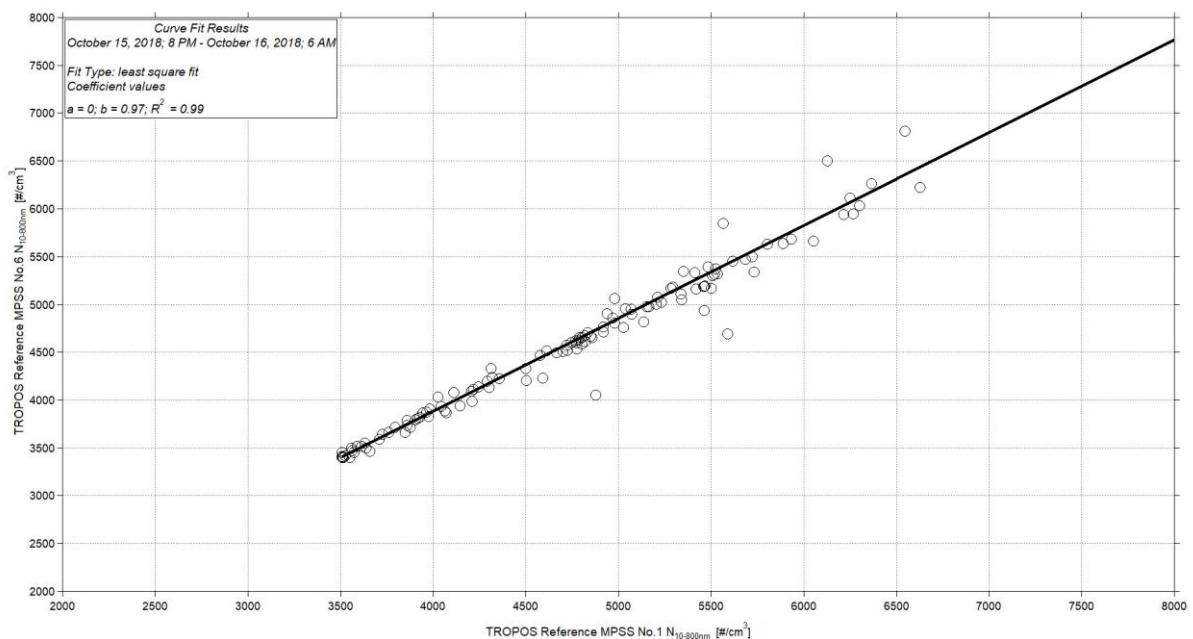


Figure 04: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference MPSS No.6. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

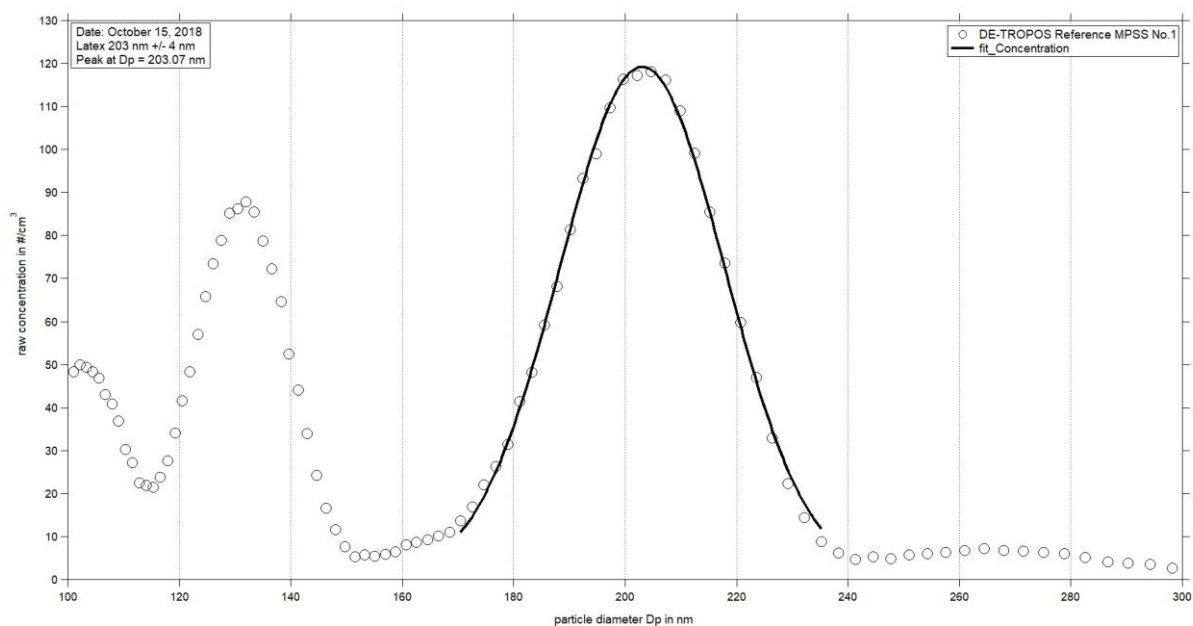
PSL Scan: Latex 203 nm +/- 4 nm

Figure 05: Measurement of latex 203 nm - Reference MPSS No.1: Particle size distribution (raw concentration) for latex 203 nm on October 15th 2018.

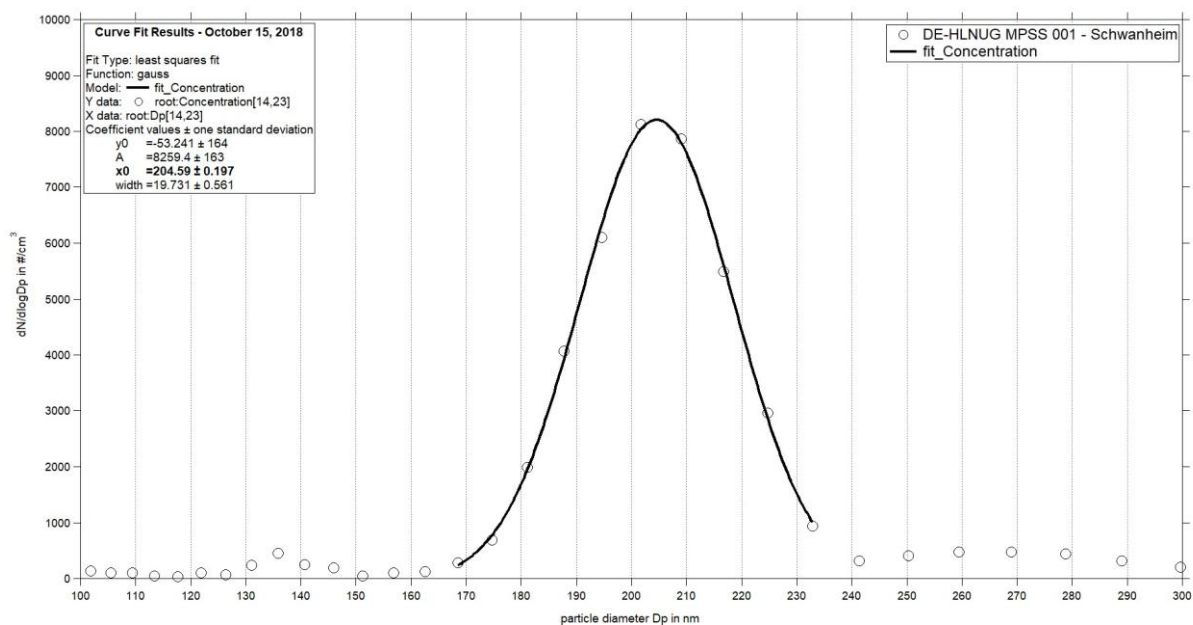


Figure 06: Measurement of latex 203 nm for the candidate DE-HLNUG MPSS 001 - Schwanheim: Particle size distribution for latex 203 nm on October 15th 2018 with a peak at 204.6 nm.

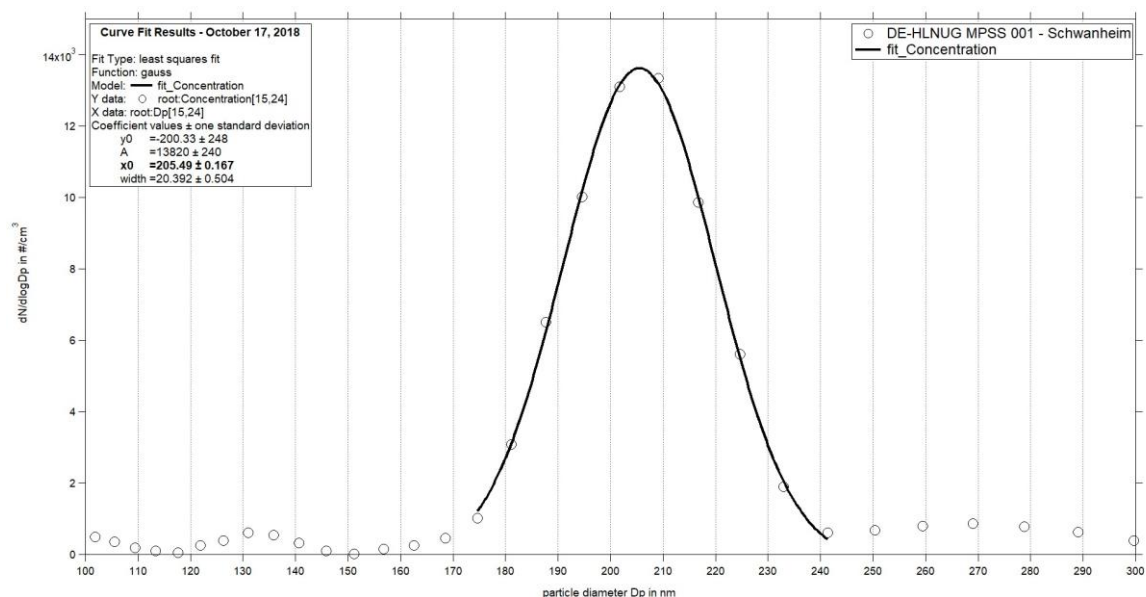


Figure 07: Measurement of latex 203 nm for the candidate DE-HLNUG MPSS 001 - Schwanheim: Particle size distribution for latex 203 nm on October 17th 2018 with a peak at 205.49 nm.

Pre-Status October 15 – 16, 2018

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

Table No. 1:

Institute: HLNUG							
Station: MPSS 001 – Schwanheim							
Date of checking list: October 15, 2019							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TSI 3082	3082001636001		ST	39.0	OFF	0.2
Firmware Classifier:	2.1		09.06.2016	CT	22.0	5 V	5.2
Firmware Software:	AIM 10			OT	40.0	10 V	10.2
DMA type:	TSI 3081A	3081A1637004		CabT	31.1	1000 V	998.2
CPC model:	TSI 3772	3772163801		AP	99.8	250 V	250.0
Firmware CPC:	2.16		Sep 2016	OP	77.5	5 V	5.2
radioactive source:	Kr.85	77A-0700	Oct 2016	NP	3.1	400 V	399.6
Flow CPC (l/min):	1.033			LC	41.0	600 V	599.3
Flow Inlet (l/min):	1.004					800 V	798.9
Flow Display (l/min):	1.17					700 V	699.0
Zero (#/cm³):	0					650 V	649.3
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:	settings like on the station						

Institute: TROPOS							
Station: Reference Instrument No.1							
Date of checking list: October 15, 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	4.98
Firmware Software:	TROPOS 6.68			OT	40.0	800 mV	999.8
DMA type:	Hauke medium		142	CabT	27.3	200 mV	250.0
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):	1.031			LC	50		
Zero (#/cm ³):	0						

Institute: TROPOS							
Station: Reference Total CPC							
Date of checking list: October 15, 2019							
Instrument/ Components	info	Serial Number	Cut off	CPC-Status			
CPC model:	TSI 3010	2410	Dp50 10 nm	ST			
Firmware CPC:	2.15			CT			
Flow Inlet (l/min):	1.015			OT			
Zero (#/cm ³):	0			CabT			
				AP			
				OP			
				NP			
				LC			

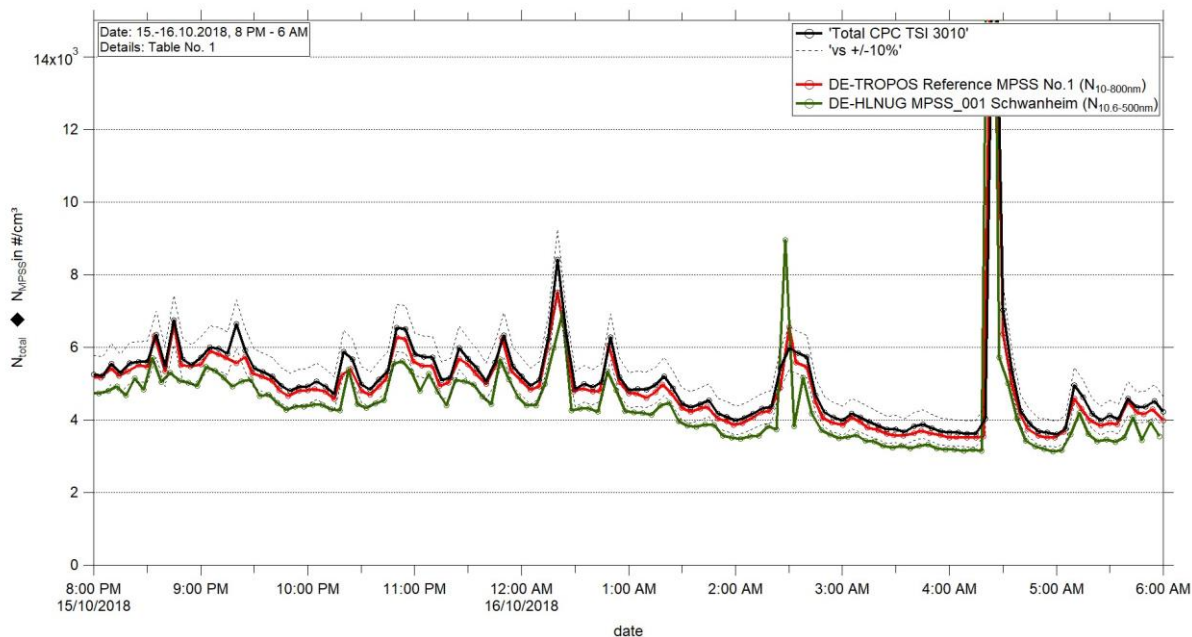


Figure 08: Time series (October 15, 2018 8 PM – October 16, 2018 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$ or $N_{10.6-500\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included. The candidate is running with the Kr.85 source.

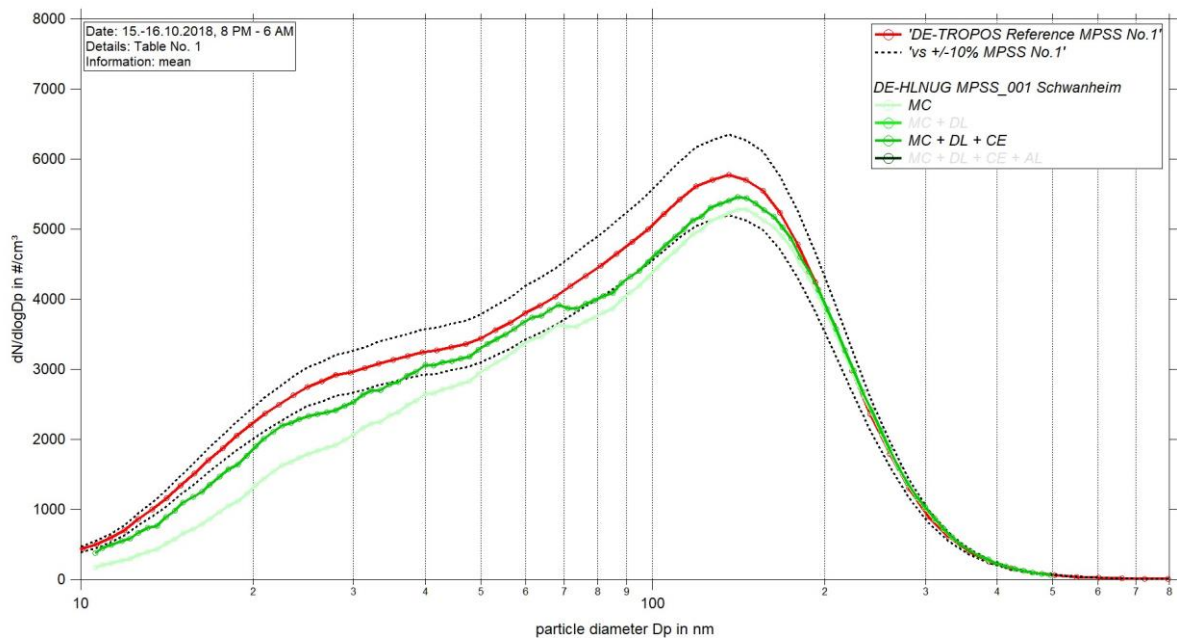


Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DE-HLNUG MPSS_001 Schwanheim from October 15, 2018 8 PM – October 16, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

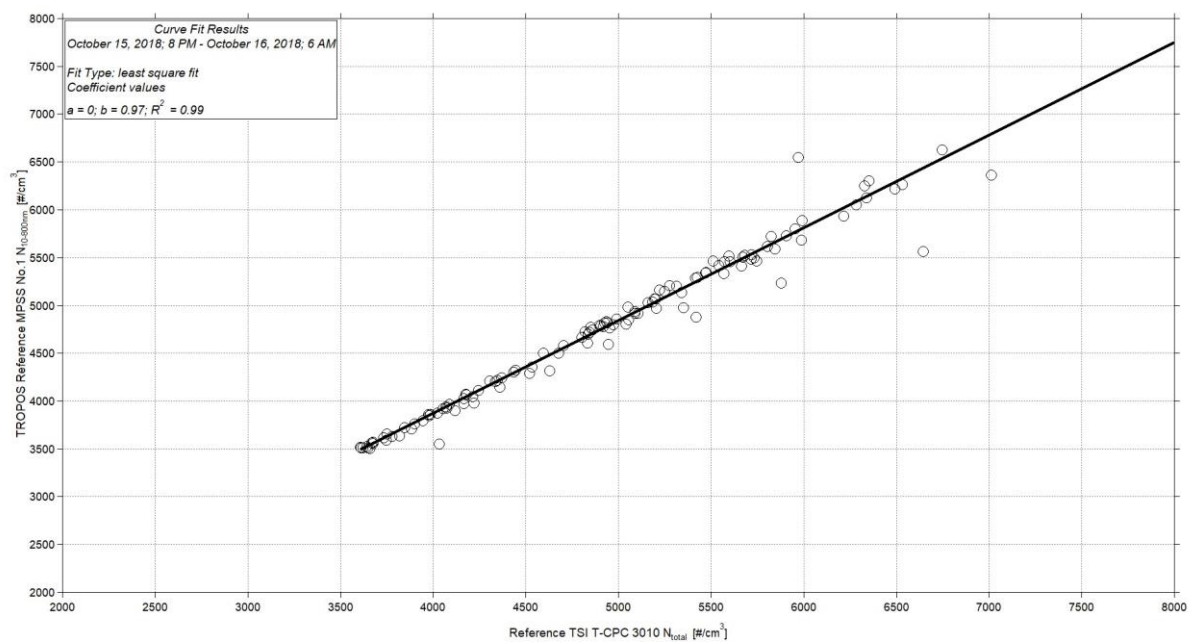


Figure 10: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

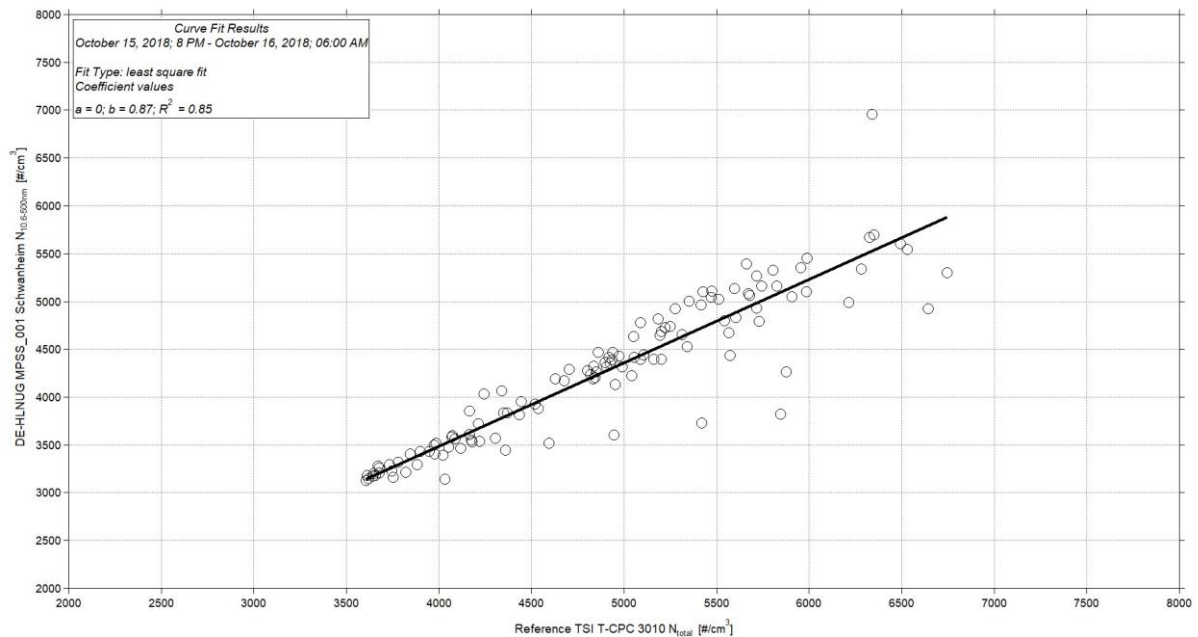


Figure 11: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and DE-HLNUG MPSS_001 Schwanheim. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

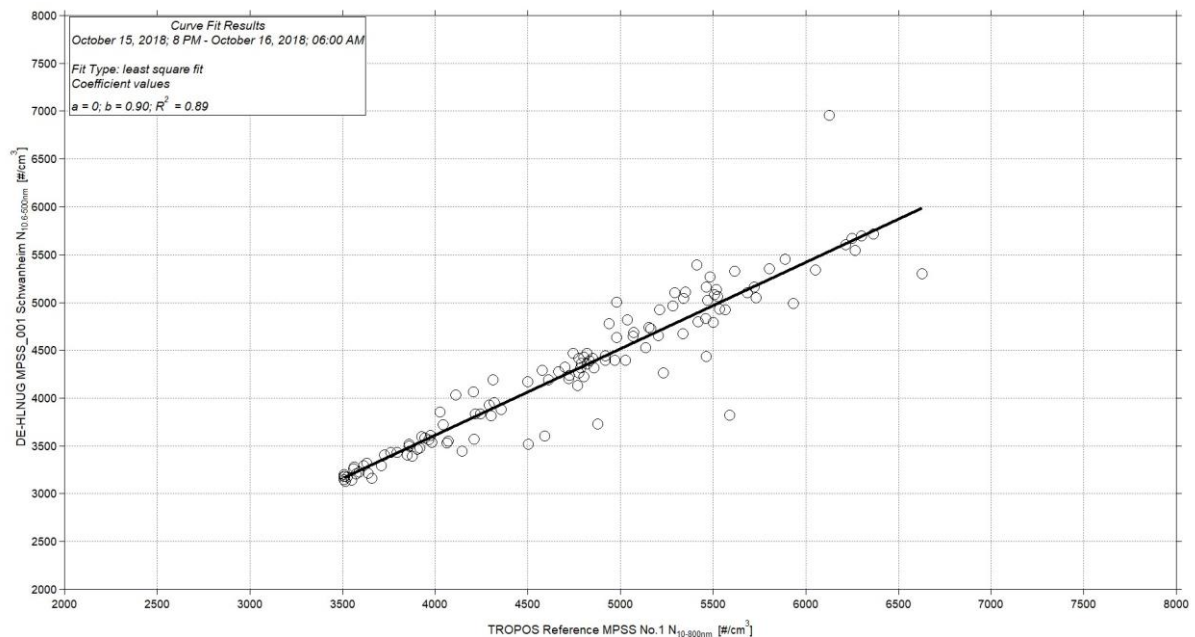


Figure 12: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-HLNUG MPSS_001 Schwanheim. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status October 16 – 17, 2018**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 2:

Institute: HLNUG							
Station: MPSS 001 – Schwanheim							
Date of checking list: October 16, 2019							
Instrument/ Components	info	SN	Date/Code	CPC-Status		HV-Status	
MPSS/Classifier:	TSI 3082	3082001636001		ST		OFF	
Firmware Classifier:	Update to 2.2		09.06.2016	CT		5 V	
Firmware Software:	AIM 10			OT		10 V	
DMA type:	TSI 3081A	3081A1637004		CabT		1000 V	
CPC model:	TSI 3772	3772163801		AP		250 V	
Firmware CPC:	2.16		Sep 2016	OP		5 V	
radioactive source:	Kr.85	77A-0700	Oct 2016	NP		400 V	
Flow CPC (l/min):	1.03			LC		600 V	
Flow Inlet (l/min):	1.01					800 V	
Flow Display (l/min):	1.04					700 V	
Zero (#/cm ³):	0					650 V	
Maintenance							
Aerosol inlet:		Checked and cleaned					
Aerosol Nafion dryer:							
Sheath Nafion dryer:							
Source:							
HV power supply:		Checked					
DMA:		Checked and cleaned					
Aerosol/sheath RH/T- sensor:							
Pressure sensor:							
Filter:							
NI-card:							
CPC:		<ul style="list-style-type: none">• CPC Workshop -> have a look at the CPC-Report• CPC was checked and cleaned -> wick changed -> CPC okay					
Impactor:		Checked and cleaned -> Display flow is correct					
Setup settings over night:		No changes – settings like on the station					

Institute: TROPOS							
Station: Reference Instrument No.1							
Date of checking list: October 16, 2019							
<i>Instrument/ Components</i>	<i>info</i>	<i>Serial Number</i>	<i>Date/Code</i>	<i>CPC-Status</i>		<i>HV-Status</i>	
MPSS/Classifier:	TROPOS	No.1		<i>ST</i>		<i>0 V</i>	
Firmware Classifier:				<i>CT</i>		<i>5 mV</i>	
Firmware Software:	TROPOS 6.68			<i>OT</i>		<i>800 mV</i>	
DMA type:	Hauke medium		142	<i>CabT</i>		<i>200 mV</i>	
CPC model:	TSI 3772	3772141701		<i>AP</i>		<i>0 V</i>	
Firmware CPC:	2.15			<i>OP</i>			
Radioactive source:	Kr.85	NER 8275	002/13	<i>NP</i>			
Flow Inlet (l/min):	1.02			<i>LC</i>			
Zero (#/cm³):	0						

Institute: TROPOS					
Station: Reference Total CPC					
Date of checking list: October 16, 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	

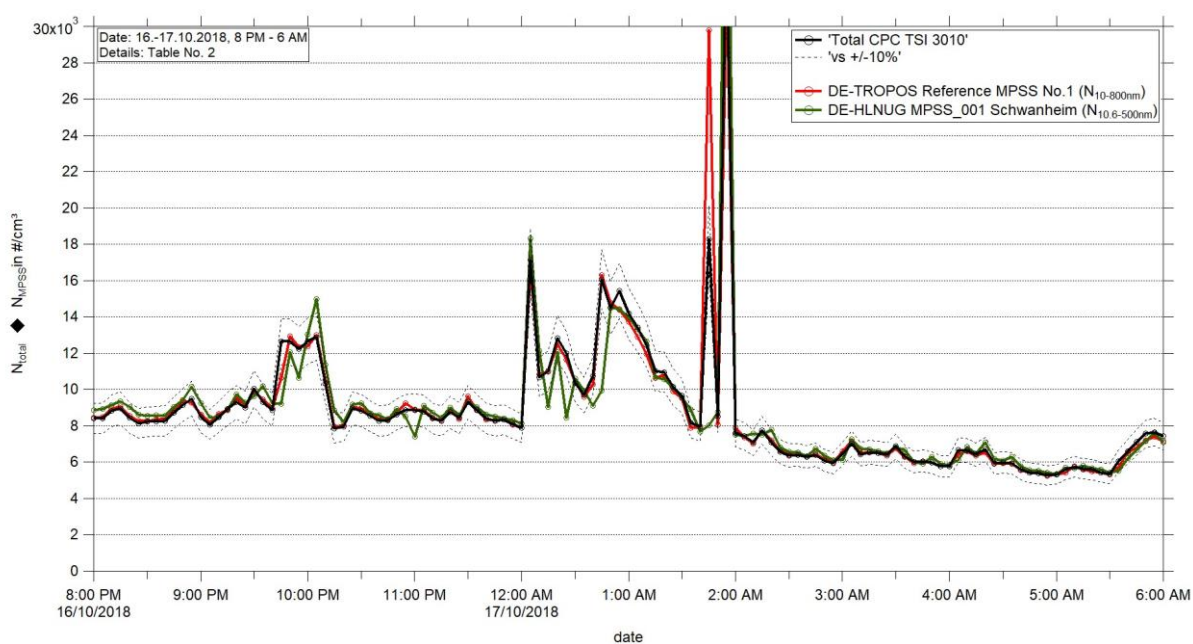


Figure 13: Time series (October 16, 2018 8 PM – October 17, 2018 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$ or $N_{10.6-500\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

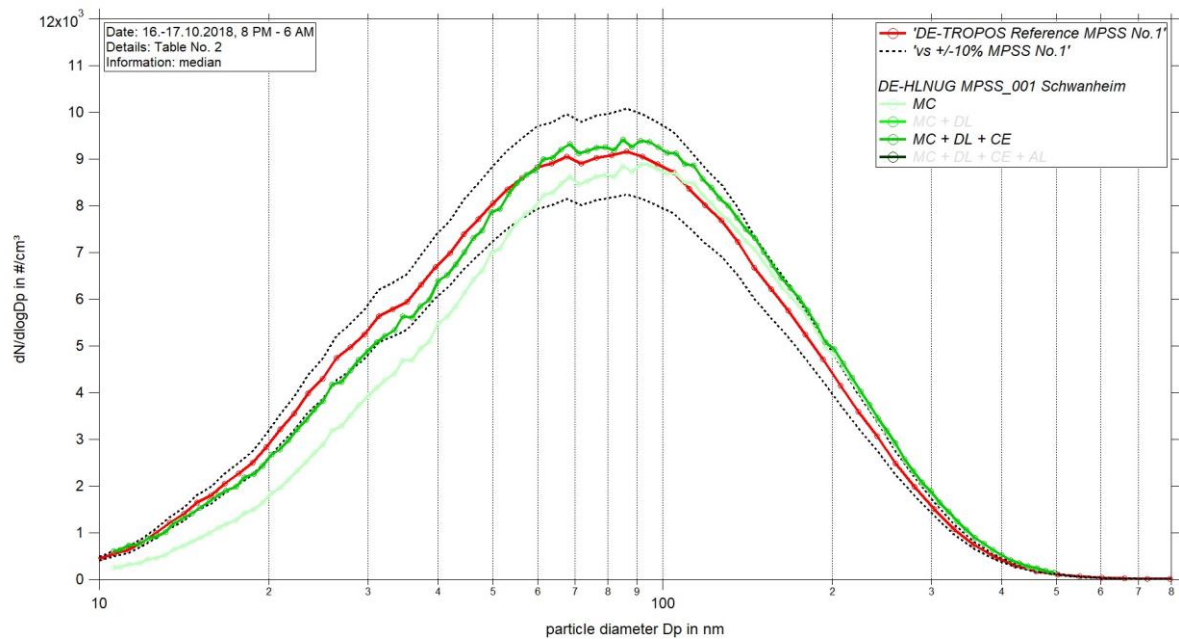


Figure 14: Comparison of median particle number size distribution of TROPOS Reference MPSS No.1 against DE-HLNUG MPSS_001 Schwanheim from October 16, 2018 8 PM – October 17, 2018 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

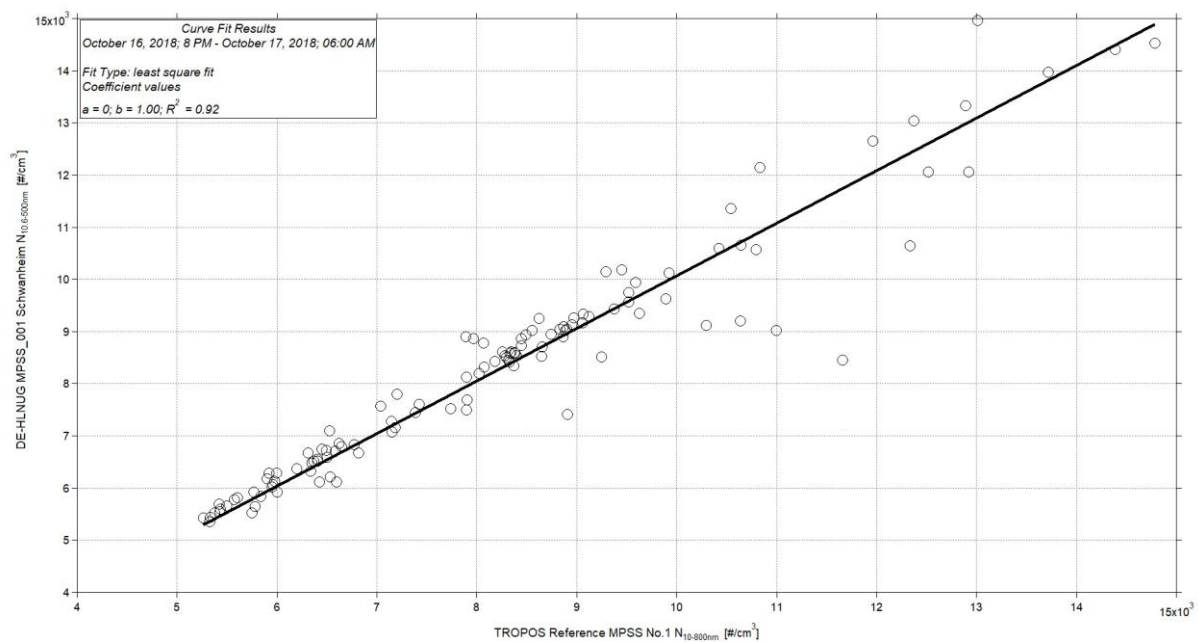


Figure 15: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-HLNUG MPSS_001 Schwanheim. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final-Status October 18 – 19, 2018**Instrument Settings, Time Series, Particle Number Size Distribution and Correlation**

Table No. 3:

<i>Institute: HLNUG</i>							
<i>Station: MPSS 001 – Schwanheim</i>							
<i>Date of checking list: October 18, 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>	TSI 3082	3082001636001		<i>ST</i>		<i>OFF</i>	
<i>Firmware Classifier:</i>	2.2		09.06.2016	<i>CT</i>		<i>5 V</i>	
<i>Firmware Software:</i>	AIM 10			<i>OT</i>		<i>10 V</i>	
<i>DMA type:</i>	TSI 3081A	3081A1637004		<i>CabT</i>		<i>1000 V</i>	
<i>CPC model:</i>	TSI 3772	3772163801		<i>AP</i>		<i>250 V</i>	
<i>Firmware CPC:</i>	2.16		Sep 2016	<i>OP</i>		<i>5 V</i>	
<i>radioactive source:</i>	Kr.85	77A-0700	Oct 2016	<i>NP</i>		<i>400 V</i>	
<i>Flow CPC (l/min):</i>				<i>LC</i>		<i>600 V</i>	
<i>Flow Inlet (l/min):</i>						<i>800 V</i>	
<i>Flow Display (l/min):</i>						<i>700 V</i>	
<i>Zero (#/cm³):</i>	0					<i>650 V</i>	
<i>Maintenance</i>							
<i>Aerosol inlet:</i>							
<i>Aerosol Nafion dryer:</i>							
<i>Sheath Nafion dryer:</i>							
<i>Source:</i>							
<i>HV power supply:</i>							
<i>DMA:</i>							
<i>Aerosol/sheath RH/T- sensor:</i>							
<i>Pressure sensor:</i>							
<i>Filter:</i>							
<i>NI-card:</i>							
<i>CPC:</i>							
<i>Impactor:</i>							
<i>Setup settings over night:</i>		<ul style="list-style-type: none">• TSI CPC 3772 had problem -> no zero, it was not possible to solve the problem -> send CPC back to TSI for maintenance• MPSS_001 is running with TROPOS CPC 3772 from Ref 6• 240s Scan					

<i>Institute:</i> TROPOS							
<i>Station:</i> Reference Instrument No.1							
<i>Date of checking list:</i> October 18, 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: 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	

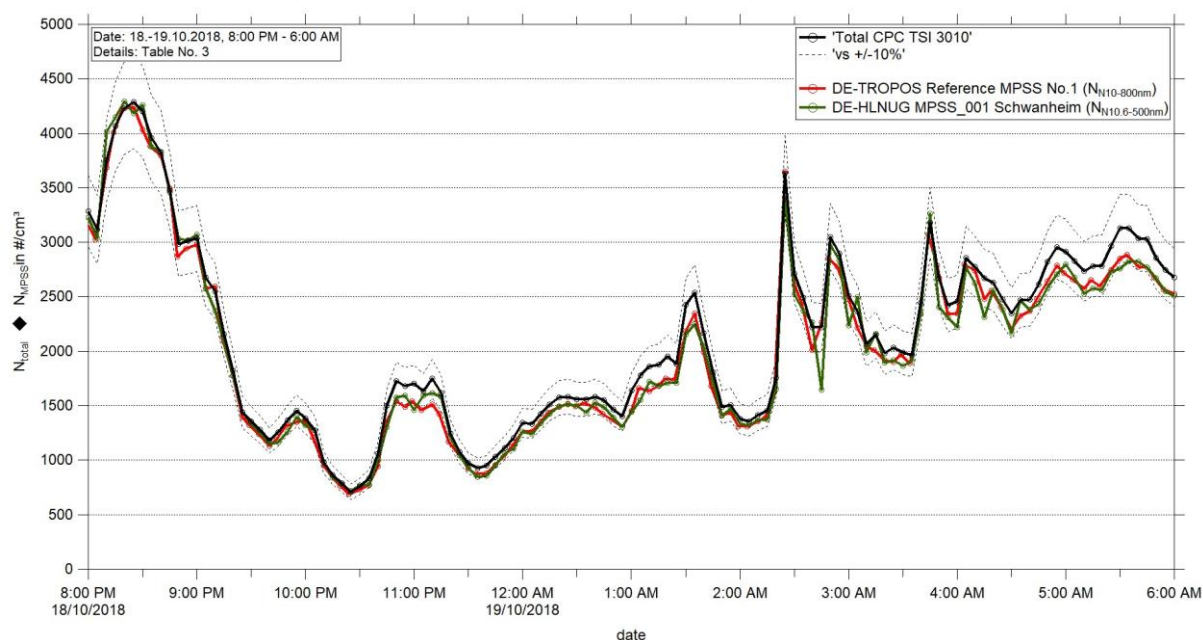


Figure 16: Time series (October 18, 2018 8 PM – October 19, 2018 6 AM) of the integrated particle number concentration ($N_{10-800\text{nm}}$ or $N_{10.6-500\text{nm}}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

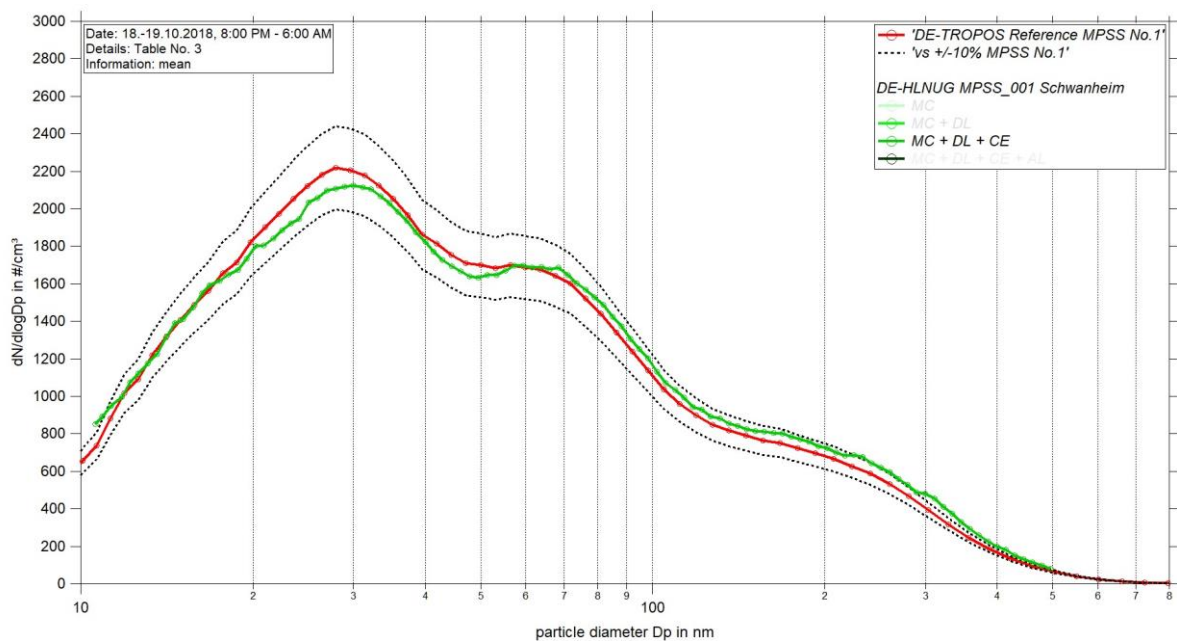


Figure 17: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DE-HLNUG MPSS_001 Schwanheim from October 18, 2018 8 PM – October 19, 2018 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included in different steps.

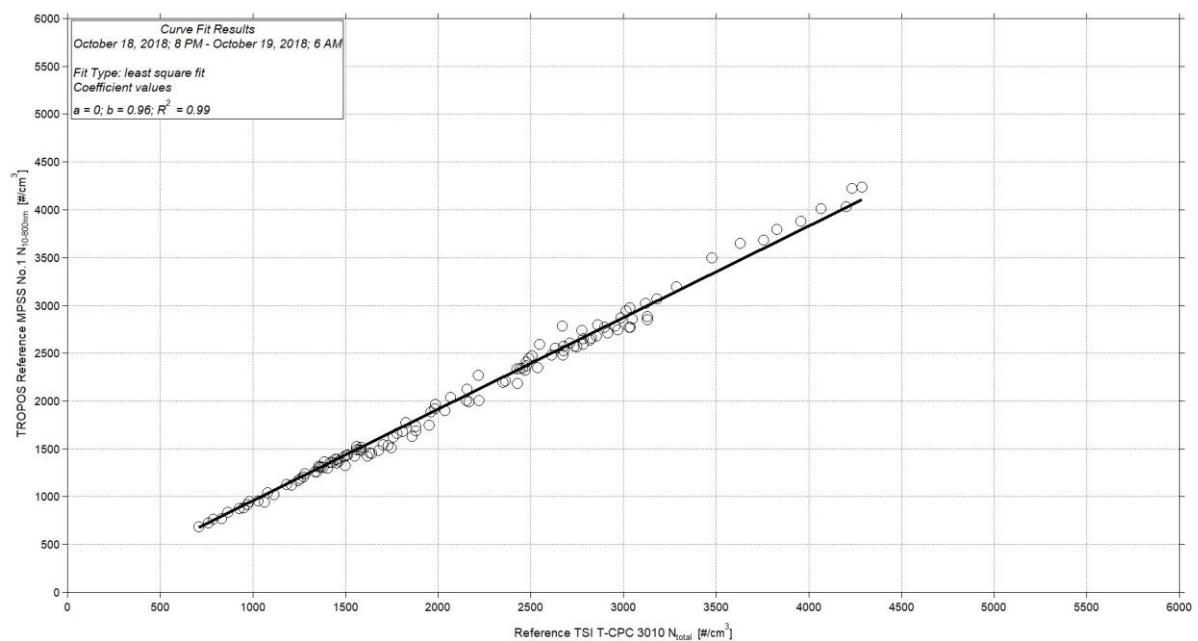


Figure 18: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

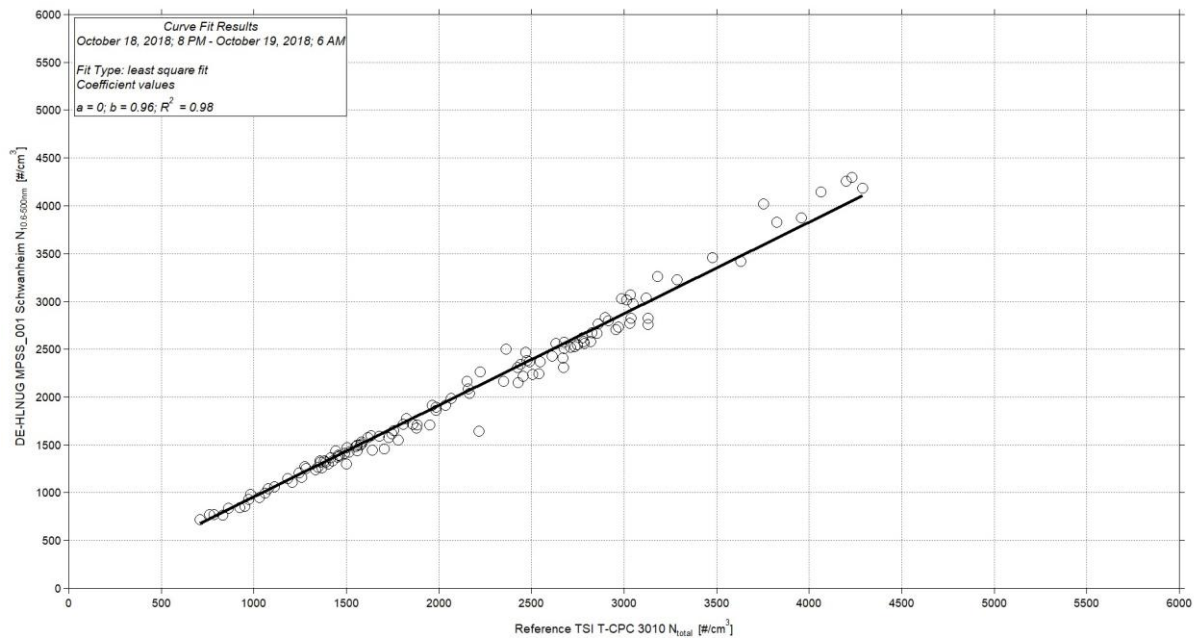


Figure 19: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3010 and DE-HLNUG MPSS_001 Schwanheim. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

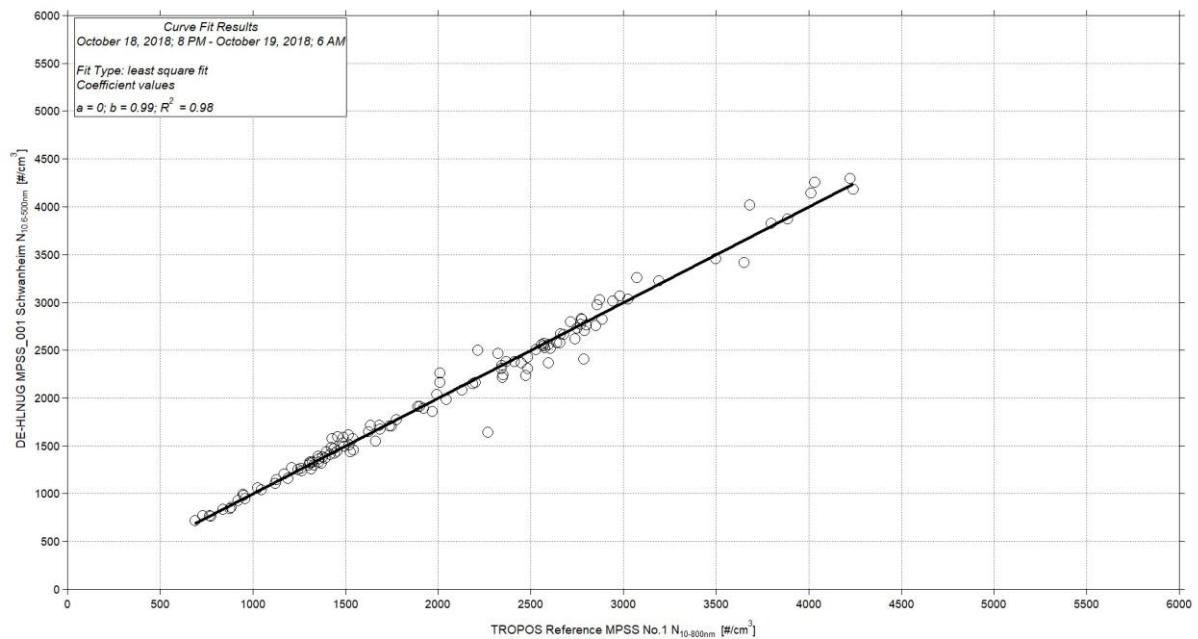


Figure 20: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-HLNUG MPSS_001 Schwanheim. Multiple charge correction, internal diffusion losses and CPC efficiency are included.