Intercomparison of Mobility Particle Size Spectrometers

Project No.:	*MPSS-2017-3-7*
Principal Investigator:	Harald Flentje
Home Institution:	*DWD* *Albin-Schweiger-Weg 10* *82383 Hohenpeißenberg*
Participant:	Björn Briel
Candidate:	**DE-DWD Hohenpeißenberg**
Made by:	
Counter (SN):	TSI CPC Model 3772, SN: 70711210
Software:	TSI
Location of the quality assurance:	TROPOS Leipzig, lab 118
Comparison period:	May 16, 2017 – May 19, 2017
Last Intercomparison (with Project No.):	

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Summary of Intercomparison:

Pre-Status:
The instrument arrived with participant. During the Pre-Status, the performance of the system showed a concentration 1% lower than the TROPOS Reference Instrument No.1. The PSL check showed a correct peak at 201.83 nm.

Final-Status:
During the Final-Status, the performance of the system showed a concentration 2% higher than the TROPOS Reference Instrument No.1. The candidate used the recalibrated TSI CPC model 3772 and their own Kr.85 source. The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments:

Date of check: May 15, 2017

List of Components	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.	Candidate
Position	Line 1	-	Line 1
Company	TROPOS	-	TROPOS
Software	TROPOS	-	TROPOS V6.66
CPC-MPSS	TSI CPC, Model 3772	-	TSI CPC, Model 3772
CPC-total	TSI CPC, Model 3010	-	TSI CPC, Model 3772
flow ratio	1.0 : 5.0	-	1.0 : 5.0
source	Kr85	-	Kr85
HV power supply	Positive	-	positive
DMA	Hauke medium	-	Hauke medium
aerosol dryer	✓	-	✓
aerosol RH- sensor	✓	-	✓
aerosol T-sensor	✓	-	✓
sheath RH-sensor	✓	-	✓
sheath T-sensor	✓	-	✓
Sheath dryer	✓	-	✓
pressure sensor	✓	-	✓
info			

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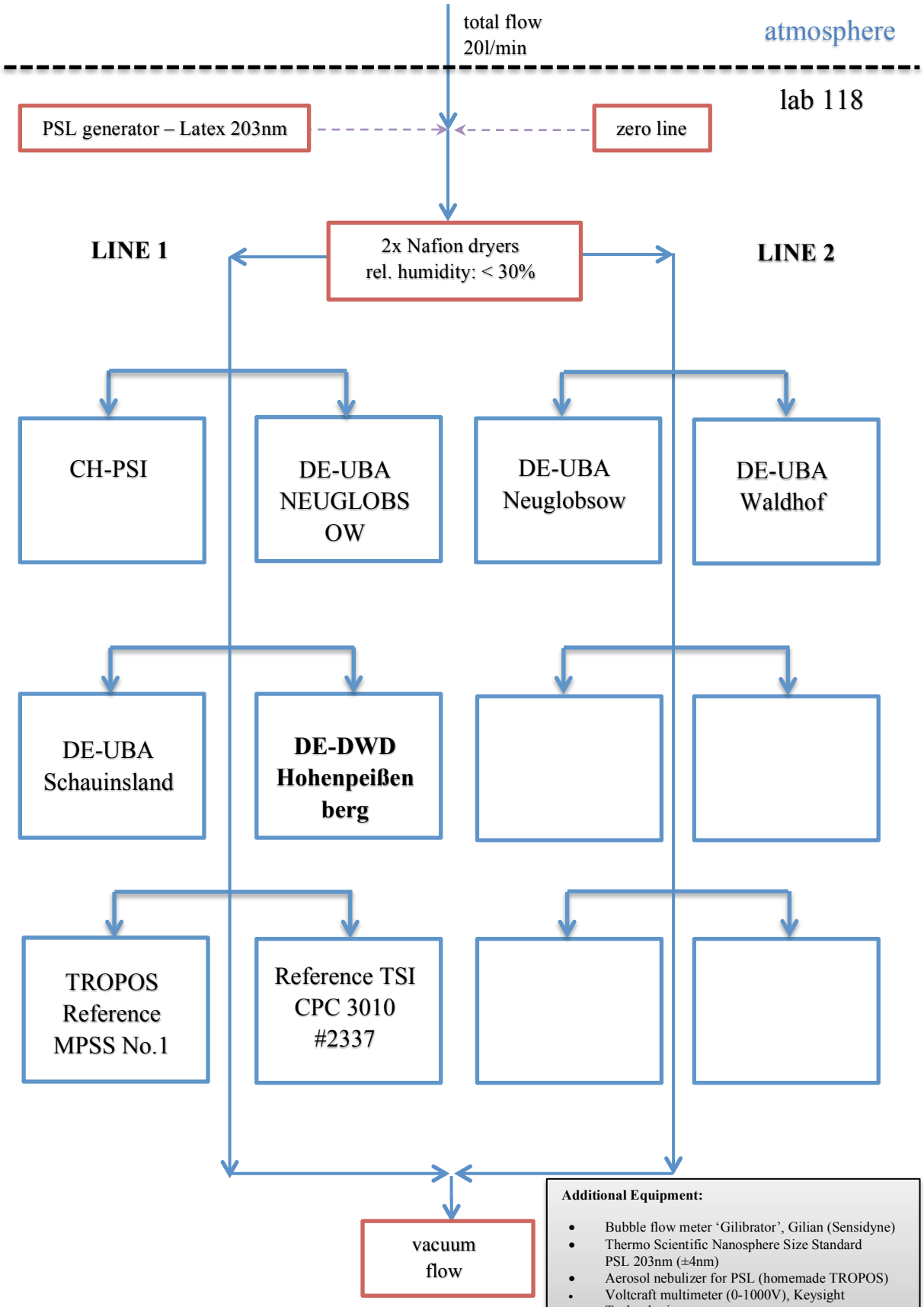
Laboratory setup:



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

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Status of the instruments:

Date of check (Pre-Status): May 15, 2017

CPC status	MPSS		Total CPC	
power/status	LED green	-	-	-
saturator temp	39.0	°C	-	°C
condenser temp	22.0	°C	-	°C
optics temp	40.0	°C	-	°C
cabinet temp	30.9	°C	-	°C
ambient pressure	100.8	kPa	-	kPa
orifice pressure	78.3	kPa	-	kPa
nozzle pressure	2.9	kPa	-	kPa
laser current	53	mA	-	mA
liquid level	full	-	-	-

Date of check (Final-Status): May 17, 2017

CPC status	MPSS		Total CPC	
power/status	LED green	-	-	-
saturator temp	39.0	°C	-	°C
condenser temp	22.0	°C	-	°C
optics temp	40.0	°C	-	°C
cabinet temp	30.6	°C	-	°C
ambient pressure	100.1	kPa	-	kPa
orifice pressure	78.1	kPa	-	kPa
nozzle pressure	2.9	kPa	-	kPa
laser current	53	mA	-	mA
liquid level	full	-	-	-

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Date of system checks:

date	15.05.2017	17.05.2017			unit
total CPC flow	-	-			l/min
aerosol flow (DMA)	-	-			l/min
aerosol flow (UDMA)	-	-			l/min
aerosol flow (total)	1.017	1.008			l/min
Zero MPSS	0	0			#/cm³
Zero total CPC	-	-			#/cm³
PSL 203 nm	201.83	202.5			nm
HV – 0 V	0.007	0.003			V
HV – 5 V	5.0	4.9			V
HV – 100 V	99.67	99.7			V
HV – 1000 V	999.3	999.6			V

Special Information regarding the Candidate:

Was it necessary to:	yes/no (date)	old part (ID/SN)	new part (ID/SN)	information
clean the aerosol inlet	yes			
change aerosol Nafion dryer	no	MT 052913-05-7	-	-
change sheath Nafion dryer	Yes	ND 0.7- 98b	ND 0.7 – 72d	No leak but the drying efficiency is not good
check source	yes	-	-	77-0497 28.5 nSv/h - okay
change HV power supply	no	-	-	
clean/change DMA	yes	-	-	Cleaned
change aerosol RH/T-sensor	no	-	-	
change sheath RH/T-sensor	no	-	-	
change pressure sensor	no	-	-	
change inlet Nafion dryer	no	-	-	-
Total filter	yes	-	-	Sheath air before DMA

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

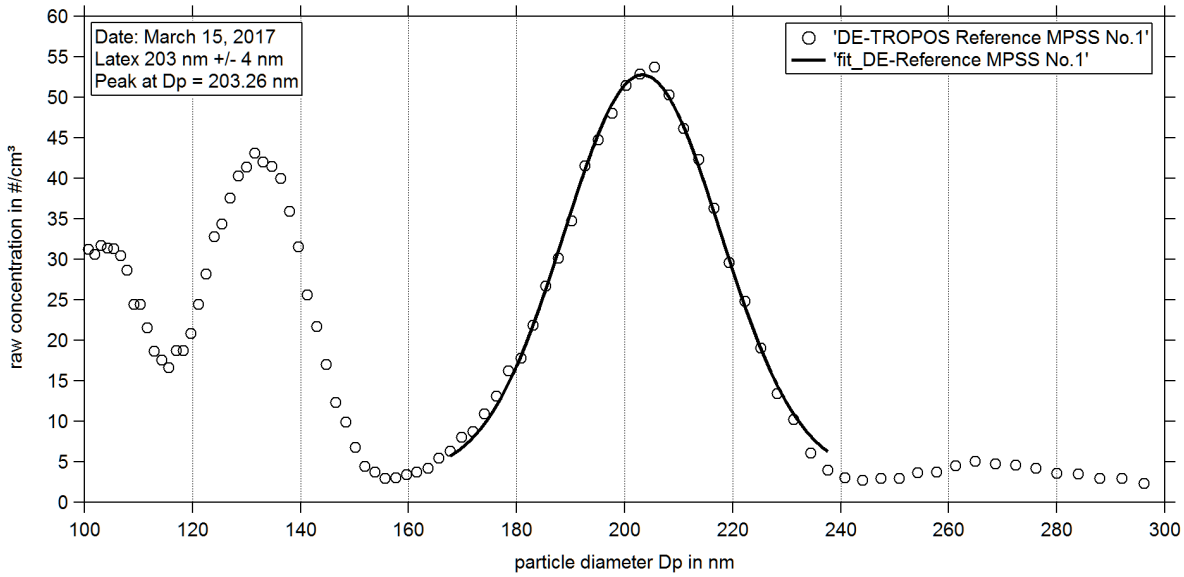

Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on May 15rd, 2017.

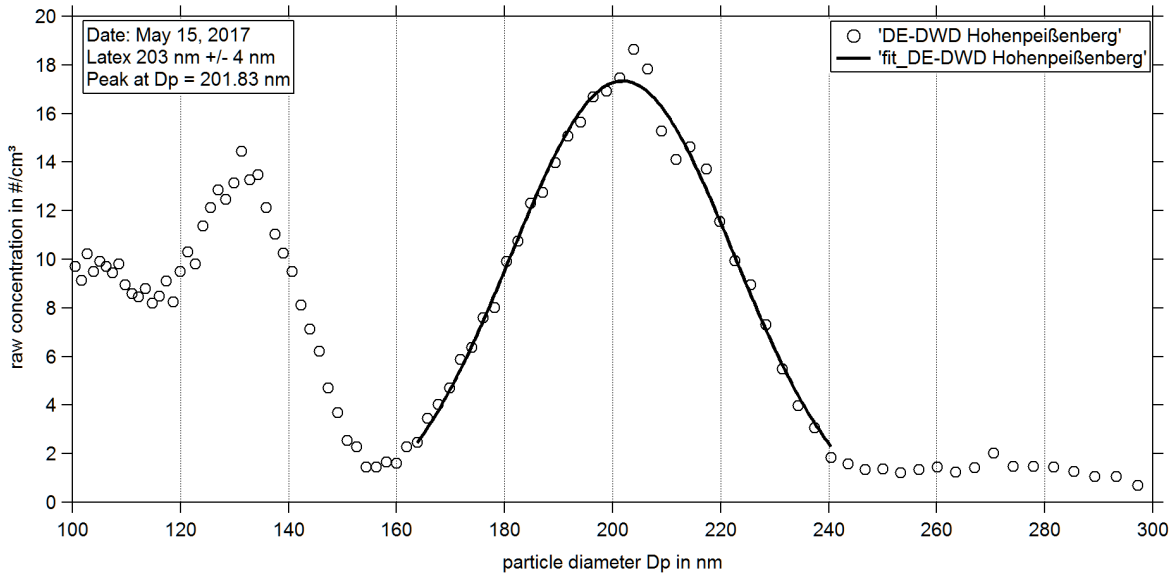

Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on May 15rd, 2017.

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Pre-Status of the Candidate: Particle Number Size Distribution

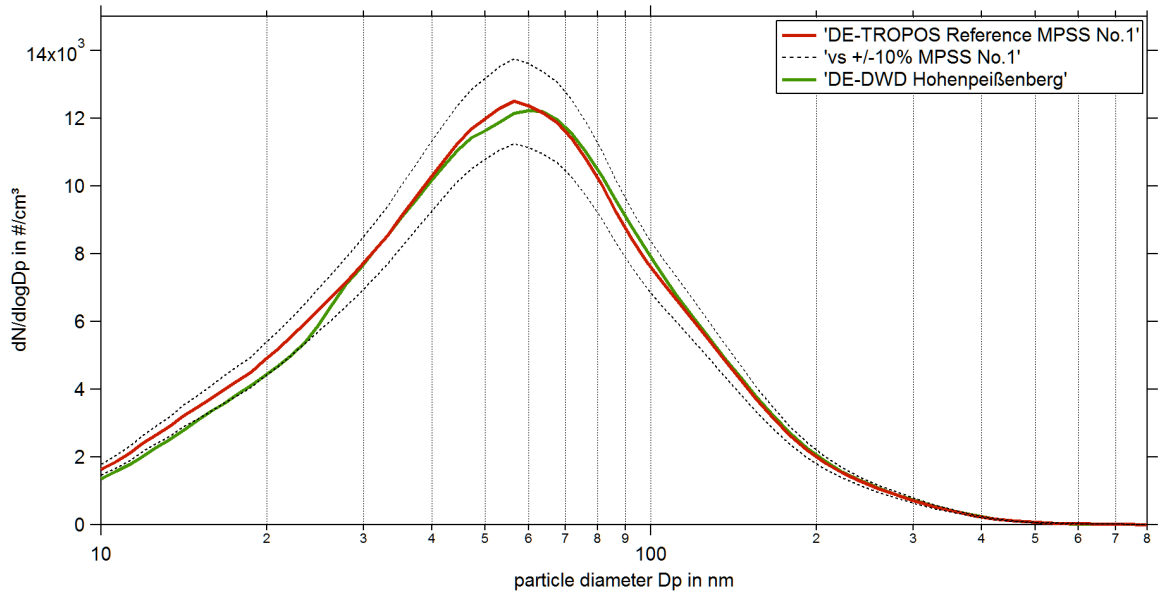

Figure 03: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DE-DWD Hohenpeißenberg from May 15, 2017 08:00 PM – May 16, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Pre-Status of the Candidate: Time Series

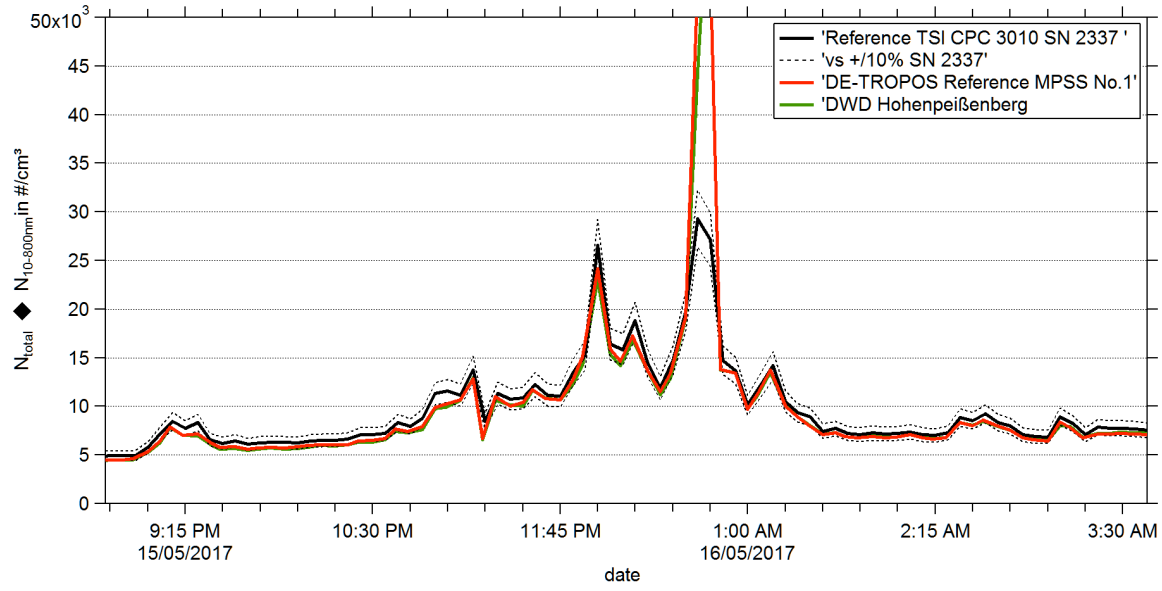

Figure 05: Time series (May 15, 2017 08:00 PM – May 16, 2017 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the

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candidate was performed using TSI software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Pre-Status of the Candidate: Correlation

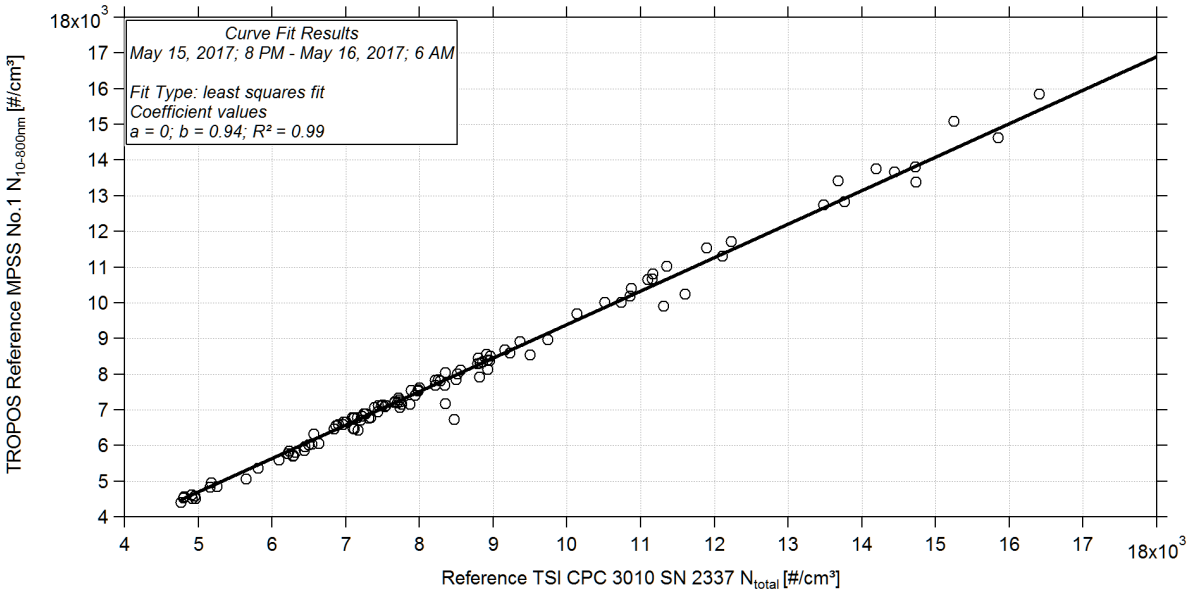

Figure 06: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

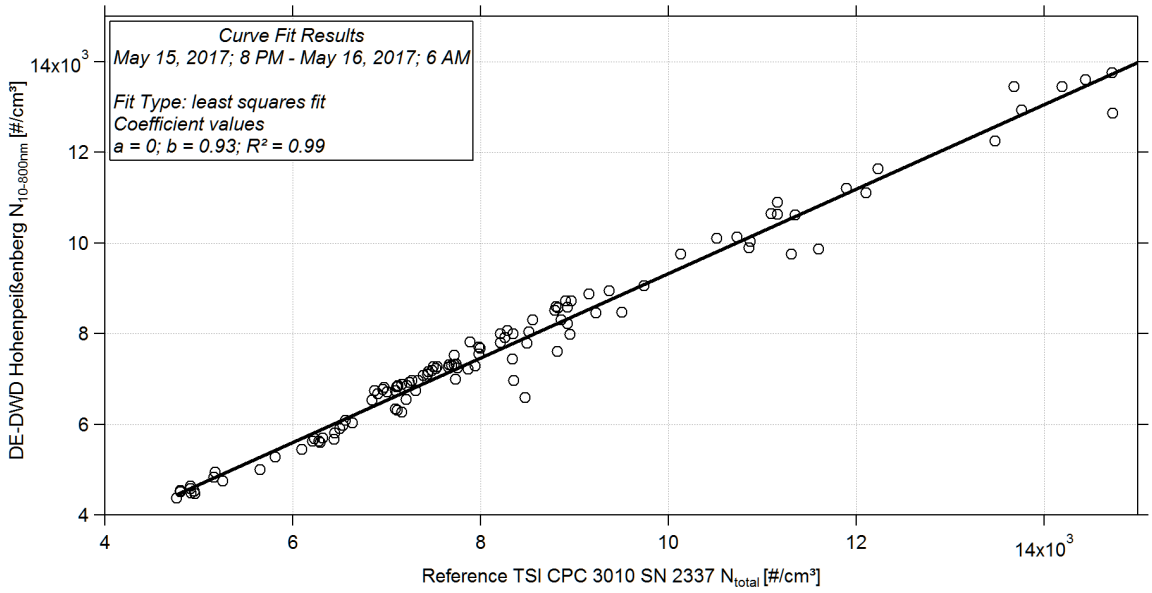

Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and DE-DWD Hohenpeißenberg. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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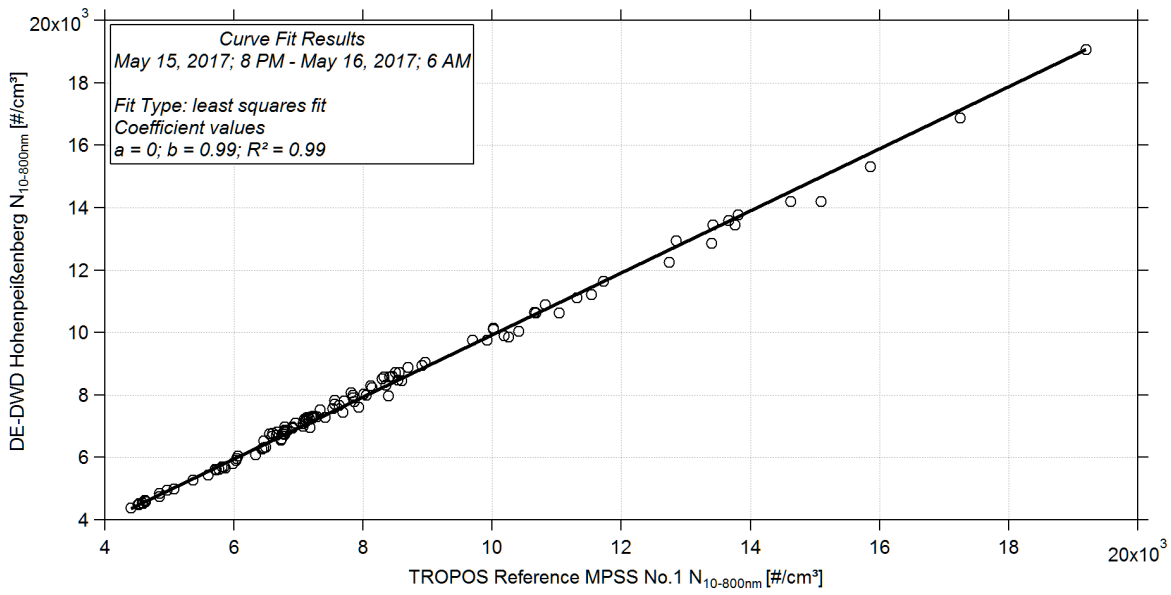

Figure 08: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-DWD Hohenpeißenberg. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final-Status of the Candidate: Particle Number Size Distribution

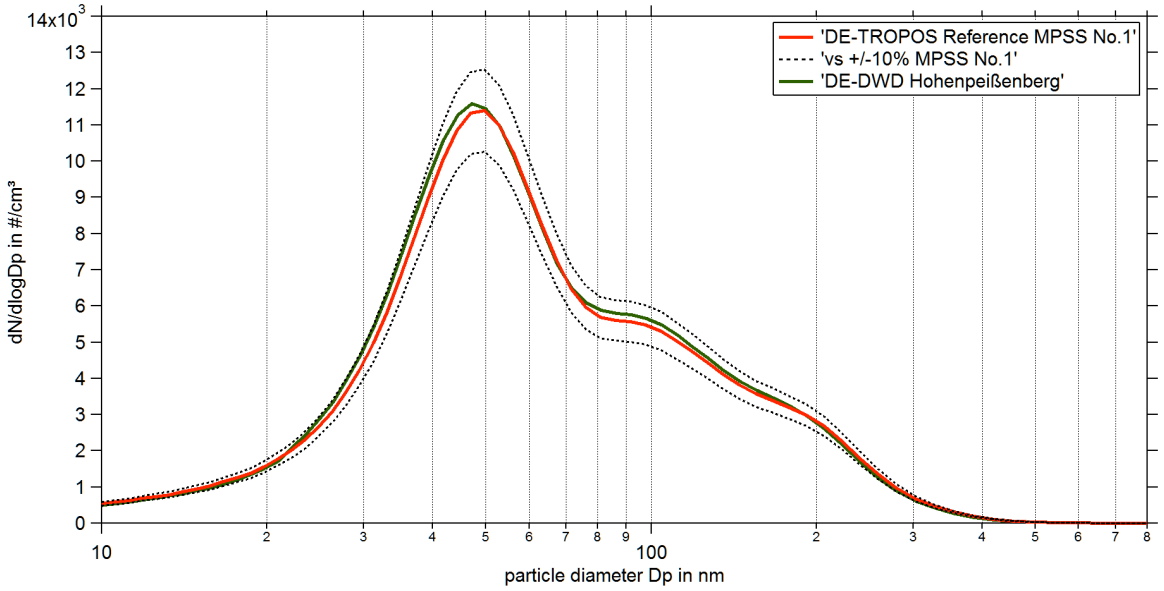

Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DE-DWD Hohenpeißenberg from May 17, 2017 06:00 PM – May 18, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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Final-Status of the Candidate: Time Series

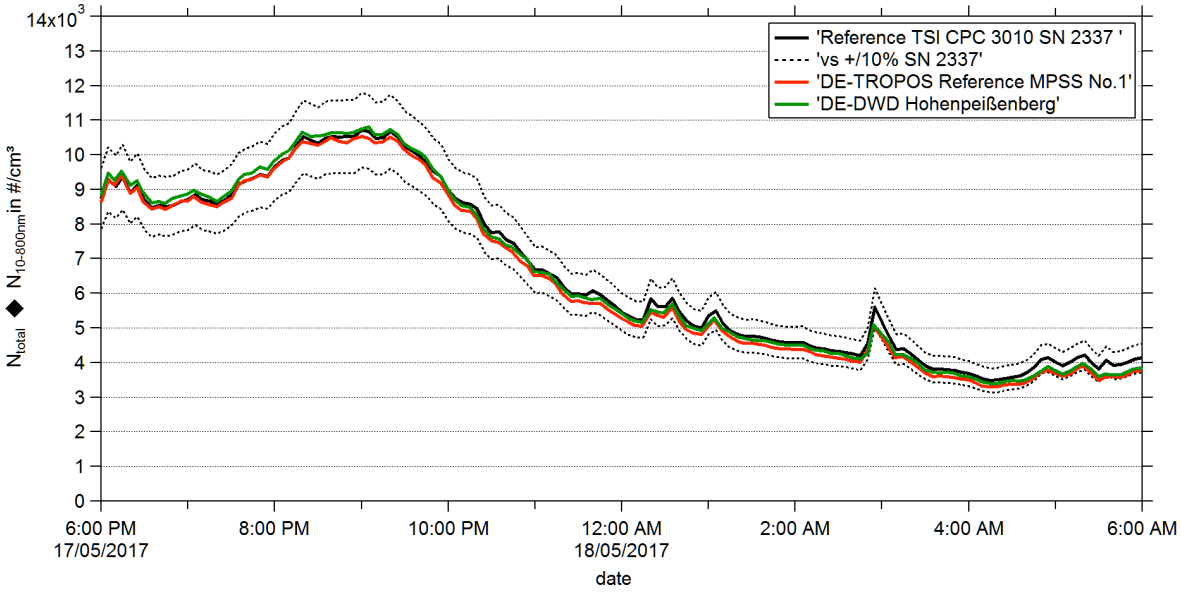

Figure 10: Time series (May 17, 2017 06:00 PM – May 18, 2017 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using TSI software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final-Status of the Candidate: Correlation

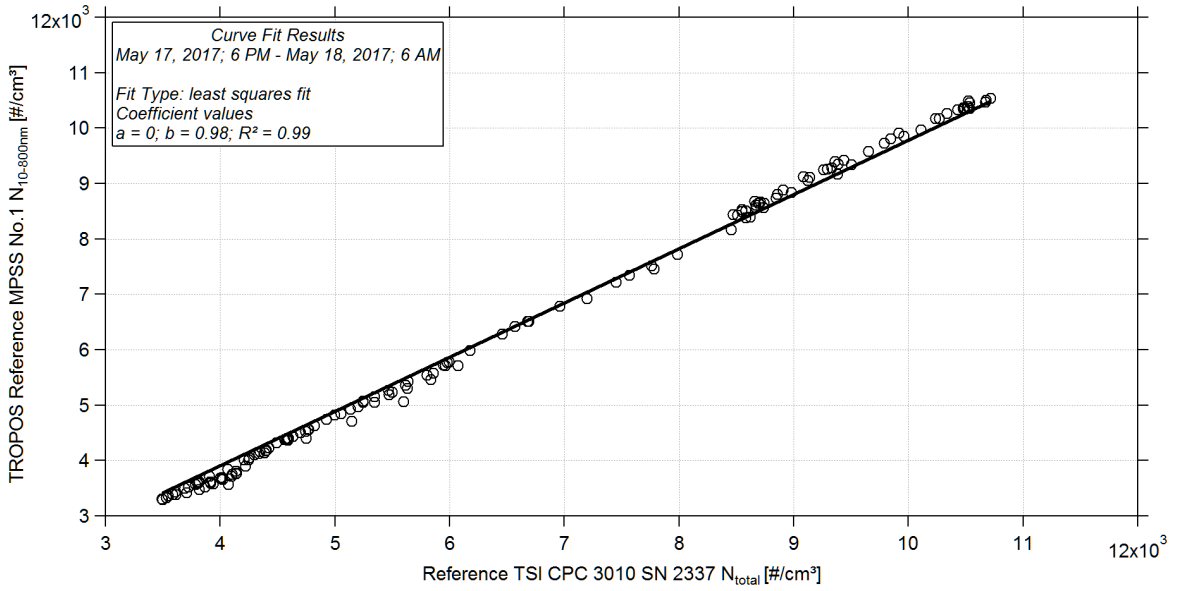

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Figure 11: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

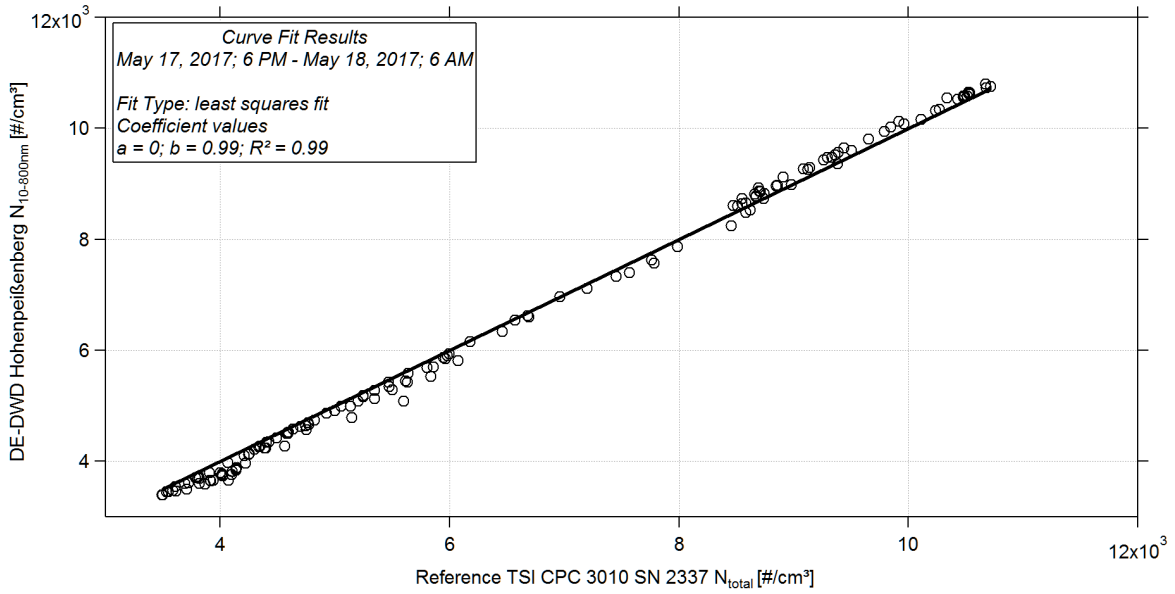

Figure 12: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and DE-DWD Hohenpeißenberg. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

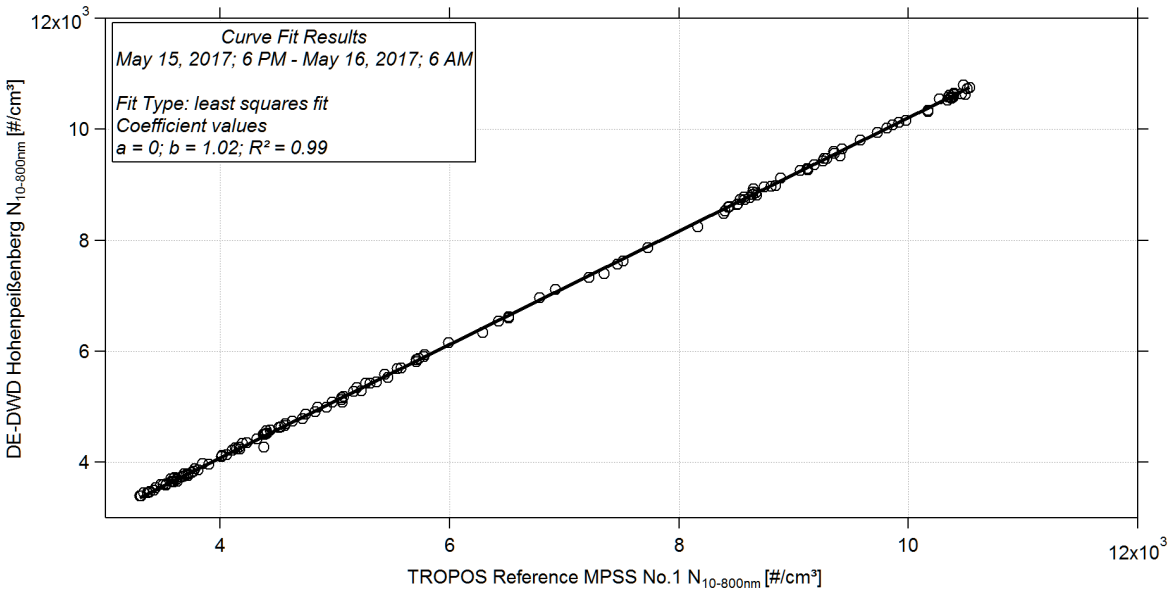

Figure 13: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-DWD Hohenpeißenberg. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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