

Intercomparison of Mobility Particle Size Spectrometers

Project No.: **MPSS-2017-3-6**

Principal Investigator: **Dr. Ludwig Ries**

Home Institution: **UBA II 4.5
Plattform Zugspitze
GAW- Globalobservatorium
Zugspitze-Hohenpeißenberg
82475 Zugspitze**

Participant: **-**

Candidate: **DE-UBA Zugspitze**

Made by:

Counter (SN): **TSI CPC Model 3772, SN: 3772161407**

Software: **TSI**

Location of the quality assurance: **TROPOS Leipzig, lab 118**

Comparison period: **June 12, 2017 – June 16, 2017**

Last Intercomparison (with Project No.):

Summary of Intercomparison:

Pre-Status:

The pre-status test showed the same results like the previous checks. The correlation against the Reference MPSS No.1 shows 8% higher concentration but the size distribution against the Reference MPSS No.1 shows size dependent differences. The system has higher diffusion losses for smaller particles. These problems were already encountered during the last ACTRIS Workshops. Hence, the Zugspitze station acquired a new home made TROPOS MPSS.

Final-Status:

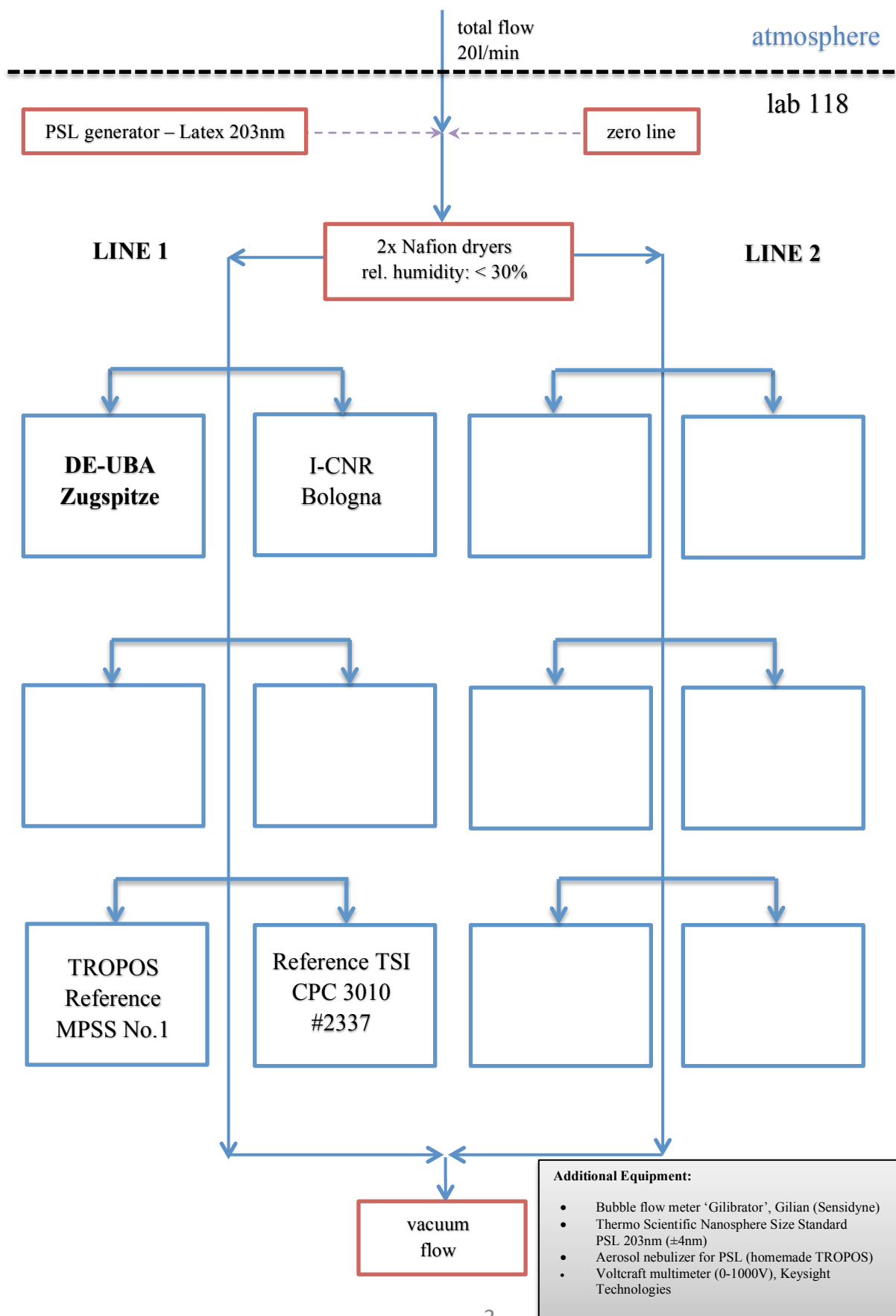
The UBA station Zugspitze is now operating with a TROPOS MPSS with the newest ACTRIS standards. During the Final-Status, the performance of the system showed the same concentration than the TROPOS Reference Instrument No.1. The PSL check showed a correct peak at 203.8 nm. The candidate used the calibrated TSI CPC model 3772 and their own Ni63 source. The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments: TROPOS MPSS

Date of check: June 15, 2017

List of Components	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.	Candidate
<i>Position</i>	Line 1	-	Line 1
<i>Company</i>	TROPOS	-	TROPOS
<i>Software</i>	TROPOS	-	TROPOS V6.68
<i>CPC-MPSS</i>	TSI CPC, Model 3772	-	TSI CPC, Model 3772
<i>CPC-total</i>	TSI CPC, Model 3010	-	-
<i>flow ratio</i>	1.0 : 5.0	-	1.0 : 5.0
<i>source</i>	Kr85	-	Ni63
<i>HV power supply</i>	Positive	-	positive
<i>DMA</i>	Hauke medium	-	Hauke medium
<i>aerosol dryer</i>	✓	-	✓
<i>aerosol RH- sensor</i>	✓	-	✓
<i>aerosol T-sensor</i>	✓	-	✓
<i>sheath RH-sensor</i>	✓	-	✓
<i>sheath T-sensor</i>	✓	-	✓
<i>Sheath dryer</i>	✓	-	✓
<i>pressure sensor</i>	✓	-	✓
<i>info</i>			new system

Laboratory setup:



Status of the instruments:

Date of check (Pre-Status): June 12, 2017

<i>CPC status</i>	MPSS		Total CPC	
<i>power/status</i>	LED green	-	-	-
<i>saturator temp</i>	39.0	°C	-	°C
<i>condenser temp</i>	22	°C	-	°C
<i>optics temp</i>	40	°C	-	°C
<i>cabinet temp</i>	30.2	°C	-	°C
<i>ambient pressure</i>	100.0	kPa	-	kPa
<i>orifice pressure</i>	79.3	kPa	-	kPa
<i>nozzle pressure</i>	2.7	kPa	-	kPa
<i>laser current</i>	41	mA	-	mA
<i>liquid level</i>	full	-	-	-

Date of check (Final-Status): June 15, 2017

<i>CPC status</i>	MPSS		Total CPC	
<i>power/status</i>	LED green	-	-	-
<i>saturator temp</i>	39.0	°C	-	°C
<i>condenser temp</i>	22	°C	-	°C
<i>optics temp</i>	40	°C	-	°C
<i>cabinet temp</i>	30.2	°C	-	°C
<i>ambient pressure</i>	100.0	kPa	-	kPa
<i>orifice pressure</i>	79.3	kPa	-	kPa
<i>nozzle pressure</i>	2.7	kPa	-	kPa
<i>laser current</i>	41	mA	-	mA
<i>liquid level</i>	full	-	-	-

Date of system checks:

<i>date</i>	12.06.2017	15.06.2017			unit
<i>total CPC flow</i>	-	-			l/min
<i>aerosol flow (DMA)</i>	-	-			l/min
<i>aerosol flow (UDMA)</i>	-	-			l/min
<i>aerosol flow (total)</i>	1.036	1.038			l/min
<i>Zero MPSS</i>	0	0			#/cm ³
<i>Zero total CPC</i>	204	203.8			#/cm ³
<i>PSL 203 nm</i>					nm
<i>HV – 0 V</i>	0.2	0.1			V
<i>HV – 5 V</i>	5.2	5.02			V
<i>HV – 100 V</i>	100.2	100.1			V
<i>HV – 1000 V</i>	1000.5	1000.1			V

Special Information regarding the Candidate: DE-UBA Zugspitze is a new TROPOS MPSS

<i>Was it necessary to:</i>	yes/no (date)	old part (ID/SN)	new part (ID/SN)	information
<i>clean the aerosol inlet</i>	no	-	-	-
<i>change aerosol Nafion dryer</i>	no	-	-	-
<i>change sheath Nafion dryer</i>	no	-	-	-
<i>check source</i>	no	-	-	-
<i>change HV power supply</i>	no	-	-	-
<i>clean/change DMA</i>	no	-	-	-
<i>change aerosol RH/T-sensor</i>	no	-	-	-
<i>change sheath RH/T-sensor</i>	no	-	-	-
<i>change pressure sensor</i>	no	-	-	-
<i>change inlet Nafion dryer (500)</i>	no	-	-	-
<i>Change Total filter</i>	no	-	-	-

Information about the instruments: TSI MPSS

Date of check: June 12, 2017

List of Components	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.	Candidate
<i>Position</i>	Line 1	-	Line 1
<i>Company</i>	TROPOS	-	TSI
<i>Software</i>	TROPOS	-	TROPOS V6.3
<i>CPC-MPSS</i>	TSI CPC, Model 3772	-	TSI CPC, Model 3772
<i>CPC-total</i>	TSI CPC, Model 3010	-	-
<i>flow ratio</i>	1.0 : 5.0	-	1.0 : 5.0
<i>source</i>	Kr85	-	Ni63
<i>HV power supply</i>	Positive	-	positive
<i>DMA</i>	Hauke medium	-	TSI
<i>aerosol dryer</i>	✓	-	-
<i>aerosol RH- sensor</i>	✓	-	✓
<i>aerosol T-sensor</i>	✓	-	✓
<i>sheath RH-sensor</i>	✓	-	✓
<i>sheath T-sensor</i>	✓	-	✓
<i>Sheath dryer</i>	✓	-	✓
<i>pressure sensor</i>	✓	-	-
<i>info</i>			Software TROPOS

Pre-Status of the Candidate: Particle Number Size Distribution

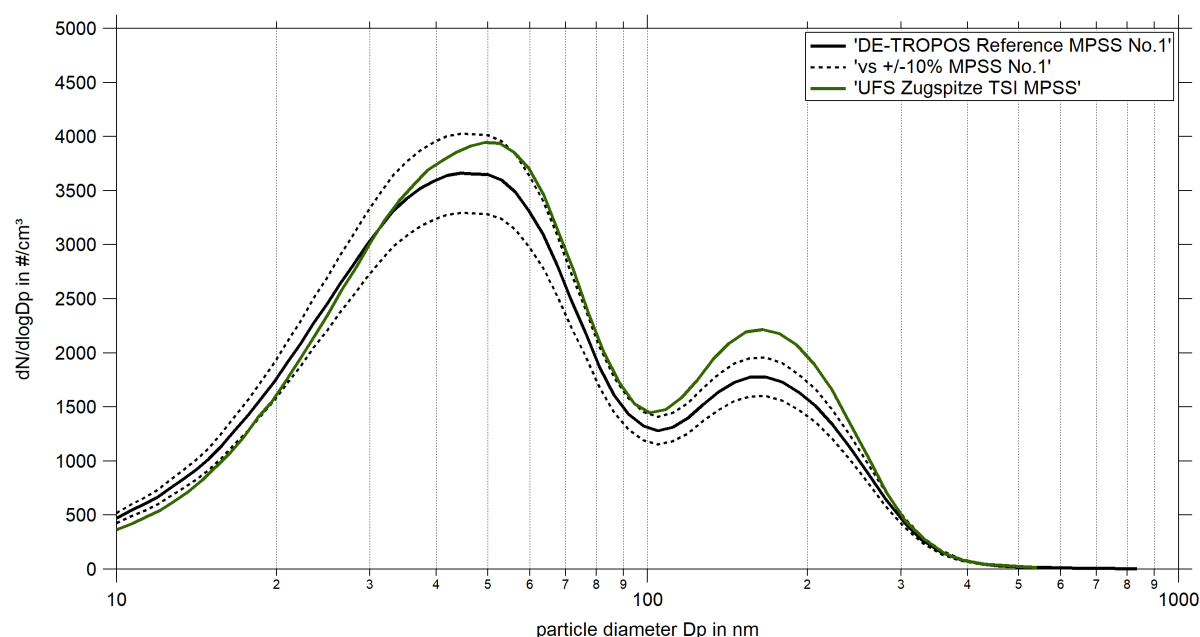


Figure 01: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DE-UBA Zugspitze from June 12, 2017 06:00 PM – June 13, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

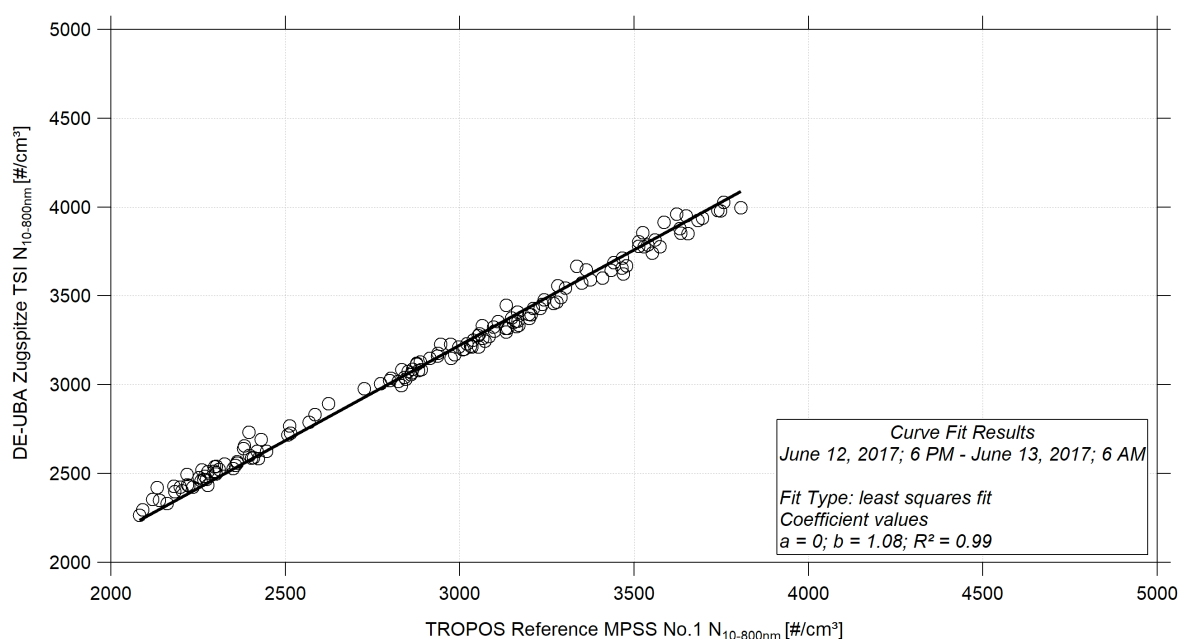


Figure 02: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-UBA Zugspitze TSI after correction (June 12, 2017 06:00 PM – June 13, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

PSL Scan and calibration: Latex 203 nm \pm 4 nm

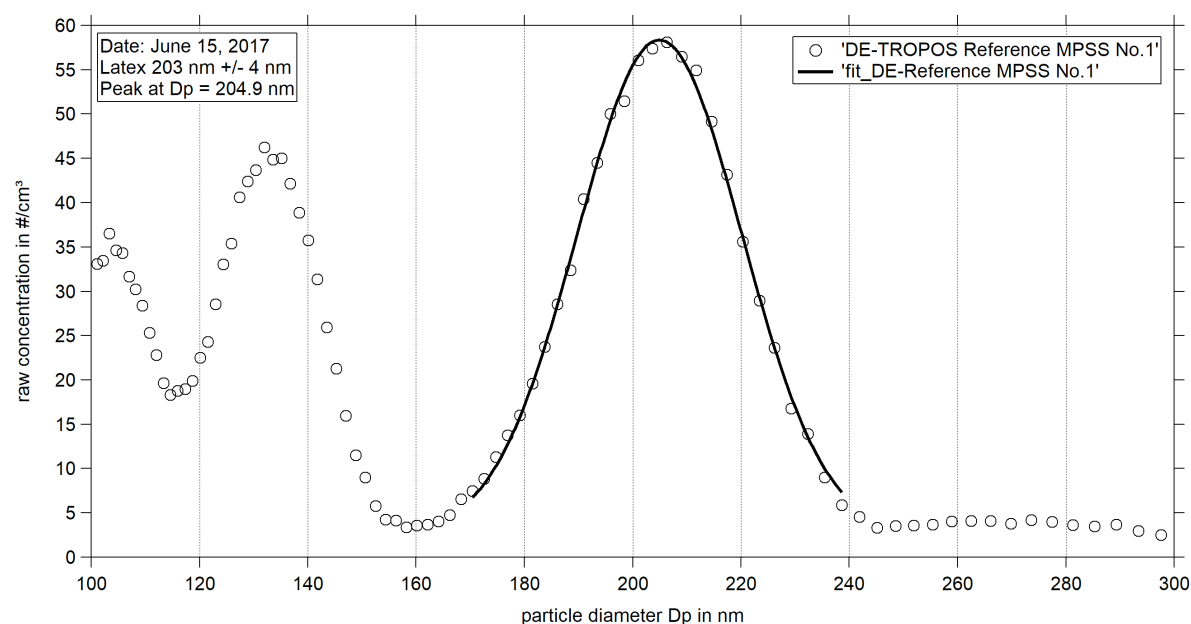


Figure 03: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 15th, 2017.

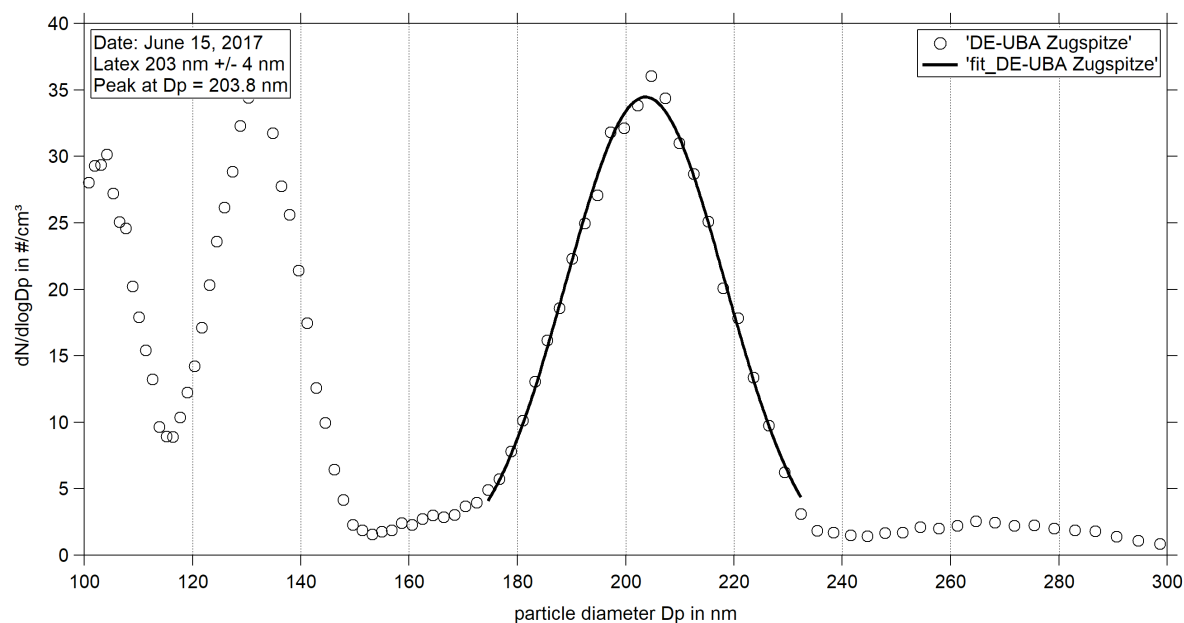


Figure 04: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 15th, 2017.

Final-Status of the Candidate: Particle Number Size Distribution

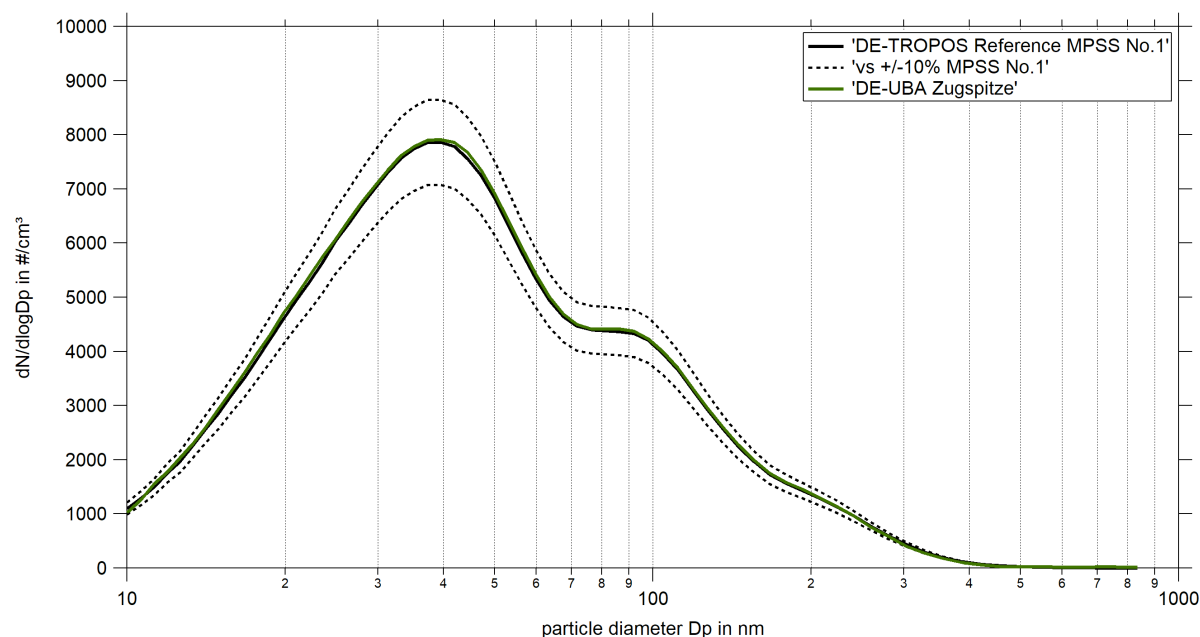


Figure 05: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DE-UBA Zugspitze from June 15, 2017 06:00 PM – June 16, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final-Status of the Candidate: Time Series

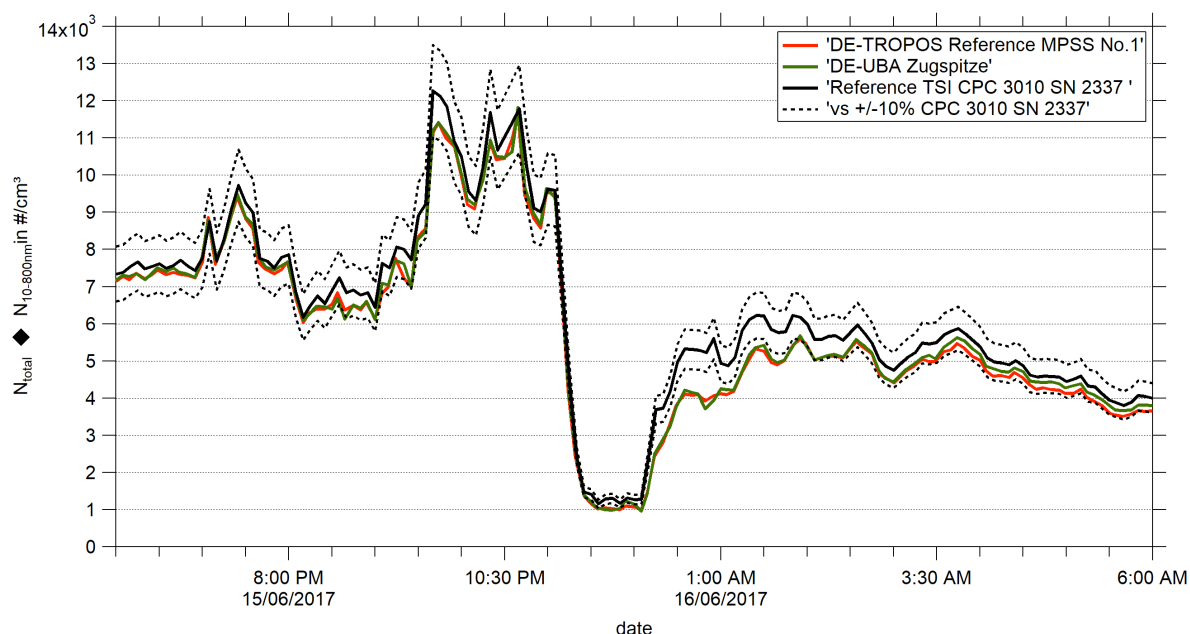


Figure 06: Time series (June 15, 2017 06:00 PM – June 16, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using TSI software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final-Status of the Candidate: Correlation

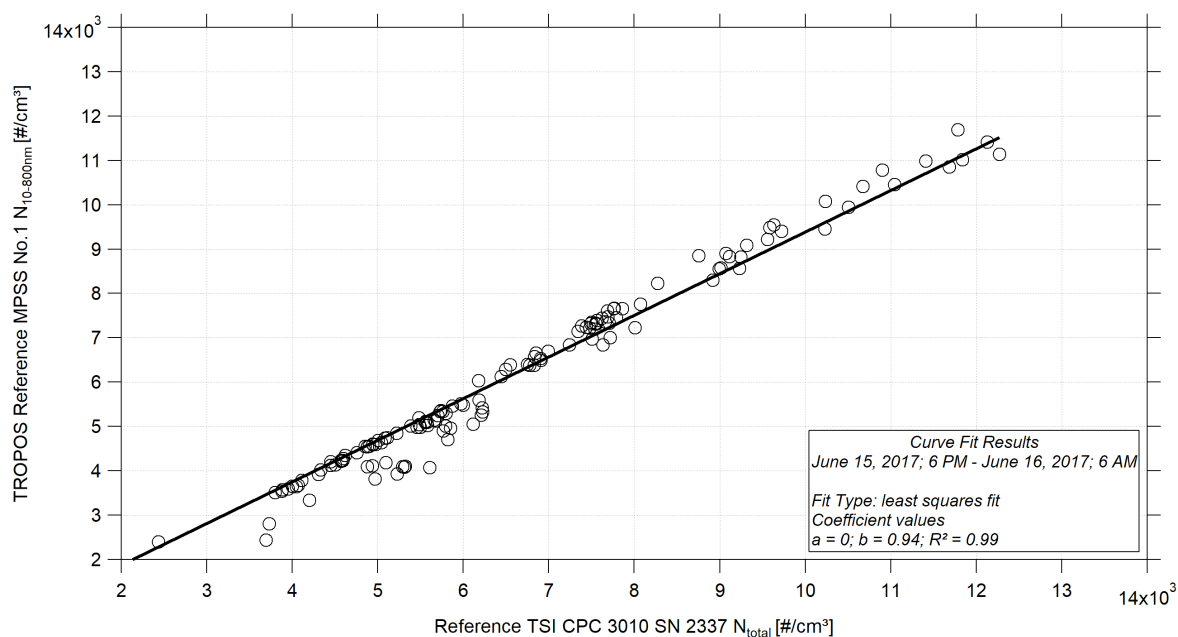


Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.1 (June 15, 2017 06:00 PM – June 16, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

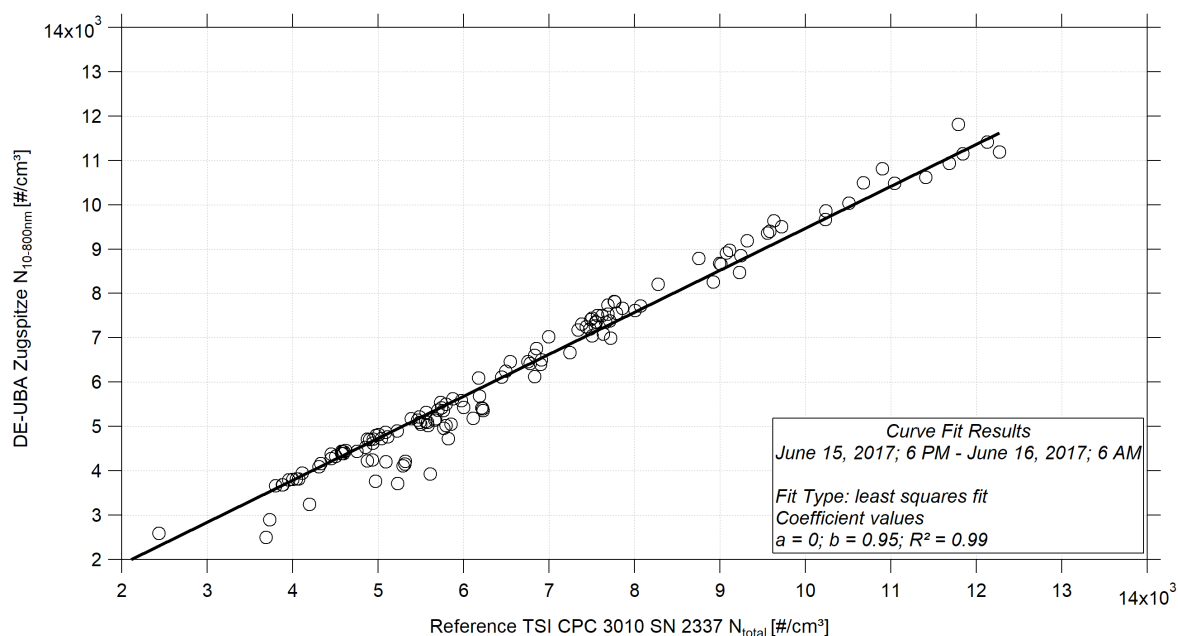


Figure 08: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and DE-UBA Zugspitze (June 15, 2017 06:00 PM – June 16, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

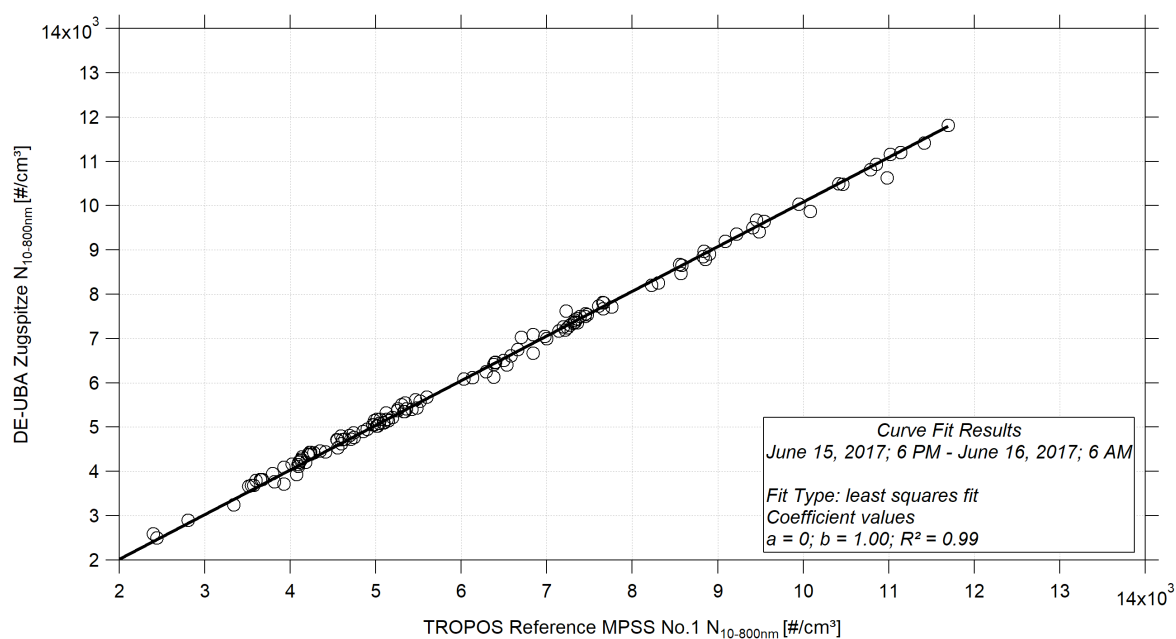


Figure 09: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-UBA Zugspitze (June 15, 2017 06:00 PM – June 16, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.