

Intercomparison of Mobility Particle Size Spectrometers

Project No.: **MPSS-2018-5-1**

Principal Investigator: **Konstantinos Eleftheriadis**

Home Institution: **DEMOKRITOS**

Participant: **-**

Candidate: **Demokritos**
Made by: **TROPOS**
Counter (SN): **TSI 3772 SN: 3772135302**
Software: **TROPOS Software V6.68**

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

Comparison period: **June 18, 2018 – June 22, 2018**

Last Intercomparison (with Project No.):

Summary of Intercomparison:*Pre-Status:*

The instrument arrived without the participant and was packed in a bad condition. Also, this instrument was running with the TROPOS Software Version 4.8. It was further verified that the TSI electronic box had several problems and the system kept crashing. During the Pre-Status, the candidate showed a concentration of 14% below the TROPOS Reference MPSS No.1. The PSL check showed a peak at 200.31 nm.

Final-Status:

During the Final-Status, the performance of the system showed a concentration of 6% below the TROPOS Reference Instrument No.1. The candidate passed the quality standards of ACTRIS and GAW.

Remarks:

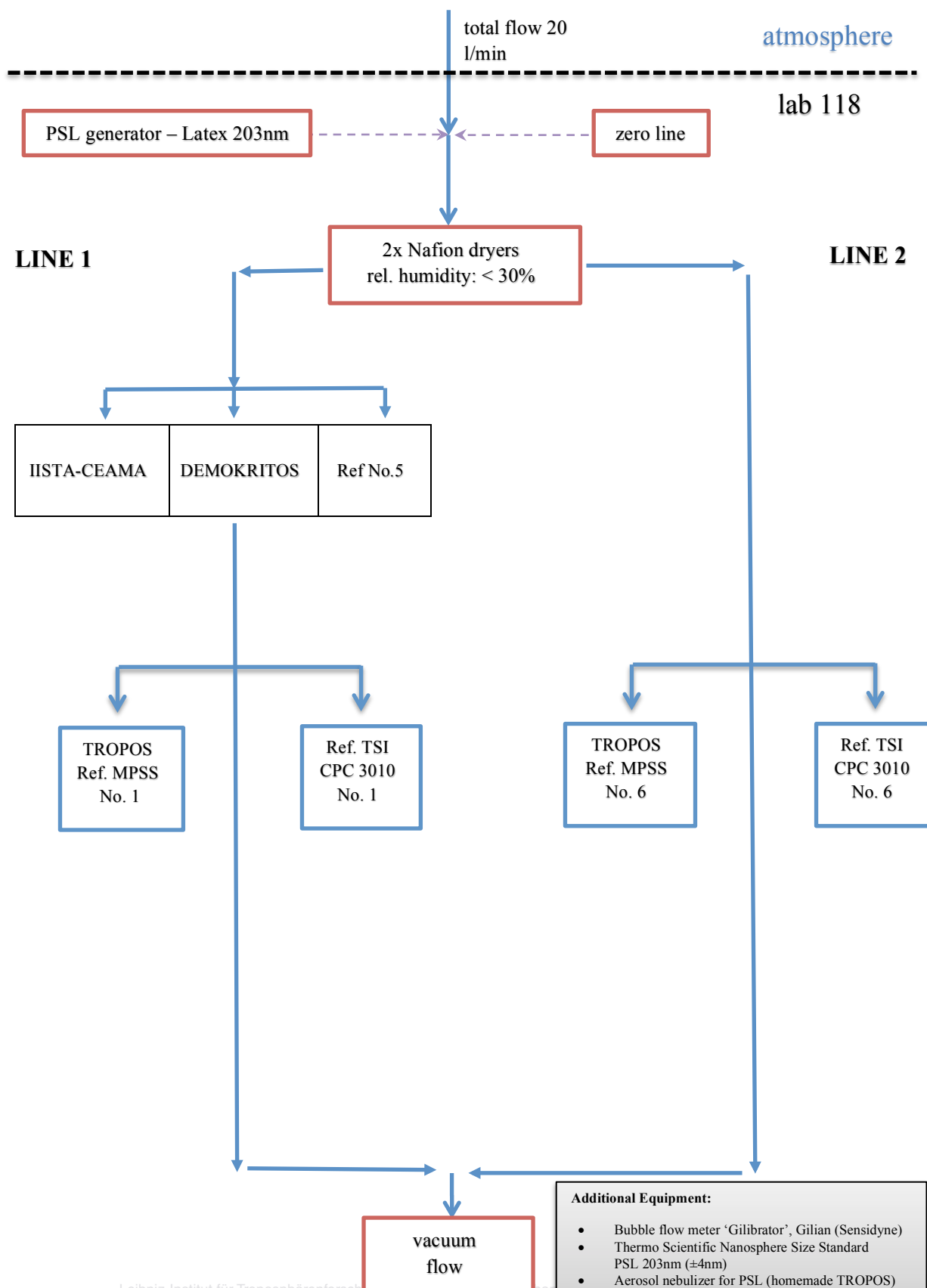
The DMA, inlet, capillary and sensors were checked and cleaned as explained below. The software was upgraded from version 4.8 to version 6.68. It was also noticed that the H/V was not stable. The H/V power supply was replaced with one from TROPOS (for testing) and the same result was obtained thus concluding that the problem is not from the H/V power supply. Additionally, several problems were encountered when using the laptop provided. Ideally this laptop should only be used for the MPSS system.

Information about the instruments:**Date of check: June 12, 2018**

<i>List of Components</i>	TROPOS Reference MPSS No.6	TROPOS Reference MPSS No.1	Candidate
<i>Position</i>	Line 2.1	Line 1.2	Line 1.3
<i>Company</i>	TROPOS	TROPOS	TROPOS
<i>Software</i>	TROPOS V6.68	TROPOS V6.68	TROPOS V6.68, MPSS modified by TROPOS
<i>CPC-MPSS</i>	TSI CPC, Model 3772	TSI CPC, Model 3772	TSI CPC, Model 3772
<i>CPC-total</i>	TSI CPC, Model 3010	TSI CPC, Model 3010	-
<i>flow ratio</i>	1.0 : 5.0	1.0 : 5.0	1.0 : 5.0
<i>source</i>	Ni.63	Kr.85	Kr-85 (TROPOS)
<i>HV power supply</i>	Positive	Positive	Positive
<i>DMA</i>	Hauke medium	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>	✓	✓	✓

pressure sensor	✓	✓	✓
info			

Laboratory setup:



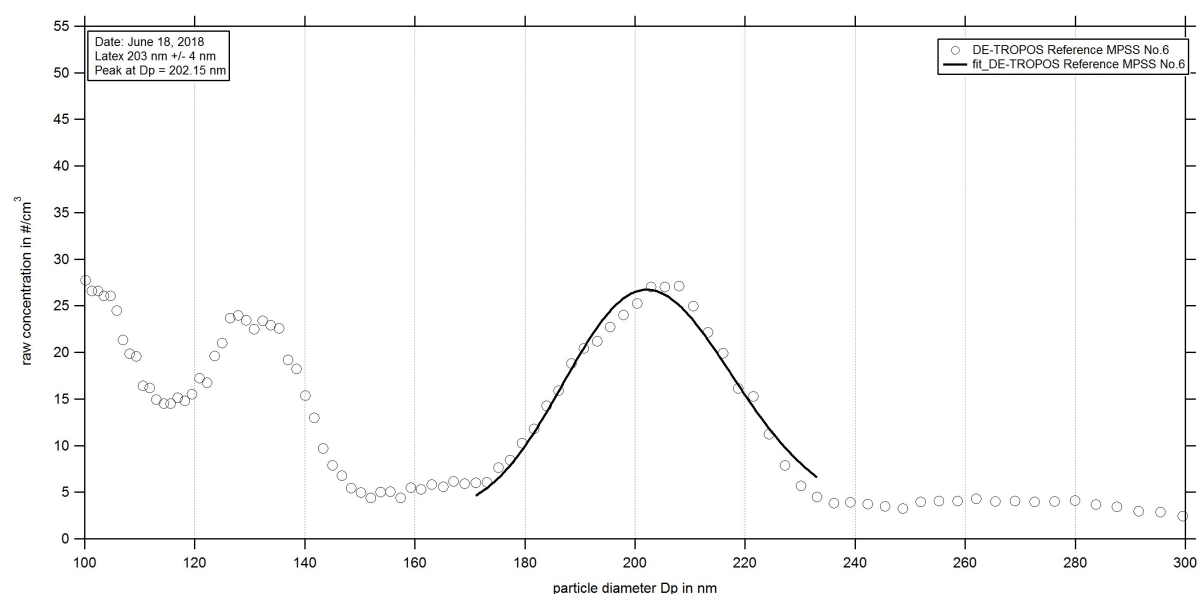
Status of the instruments:

Date of system checks:

<i>date</i>	19.06.2018	26.06.2018	unit
<i>total CPC flow</i>	-	-	l/min
<i>aerosol flow (DMA)</i>	1.001	0.992	l/min
<i>aerosol flow (UDMA)</i>	-		l/min
<i>aerosol flow (total)</i>	1.001	0.992	l/min
<i>Zero MPSS</i>	0	0	#/cm ³
<i>Zero total CPC</i>	-	-	#/cm ³
<i>PSL 203 nm</i>	200.31 (settings 4.8)	201.38 (settings 4.8)	nm

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	-	-	checked
change aerosol Nafion dryer	No	-	-	-
change sheath Nafion dryer	Yes	-	-	checekd
check source	Yes	-	-	Kr-85 (TROPOS)
change HV power supply	No	-	-	only for testing – not stable
clean/change DMA	Yes	-	-	checked and cleaned
change aerosol RH/T-sensor	No	-	-	checked
change sheath RH/T-sensor	No	-	-	checked
change pressure sensor	No	-	-	checked
change inlet Nafion dryer (500)	No	-	-	-
Change Total filter	-	-	-	-
NI-card	No			checked

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 June 18th, 2018.

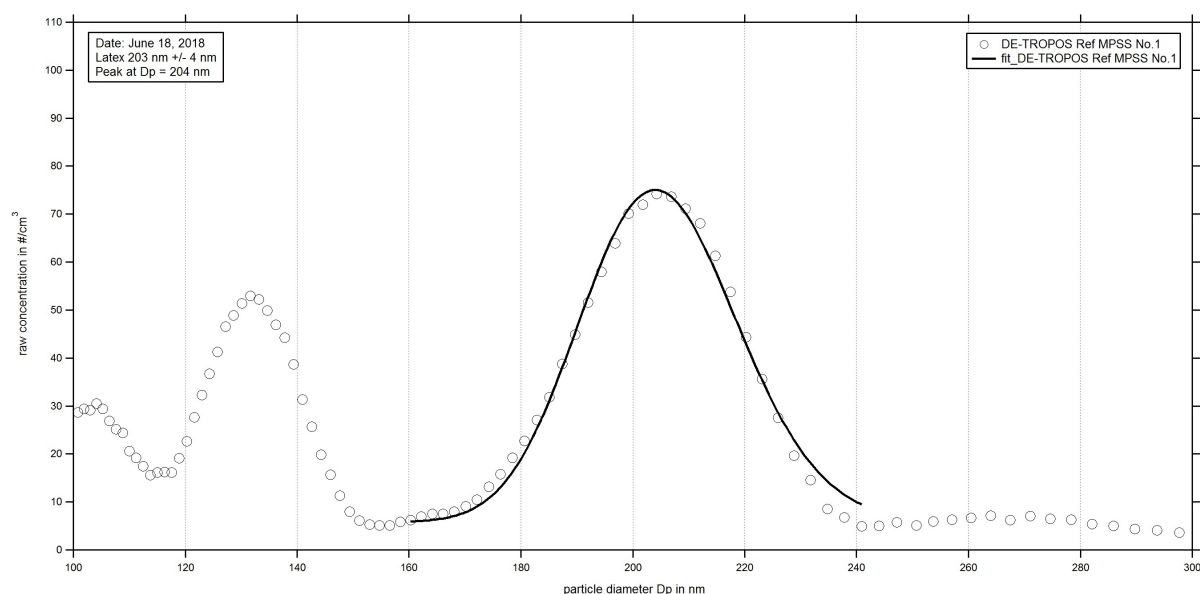


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 18th, 2018.

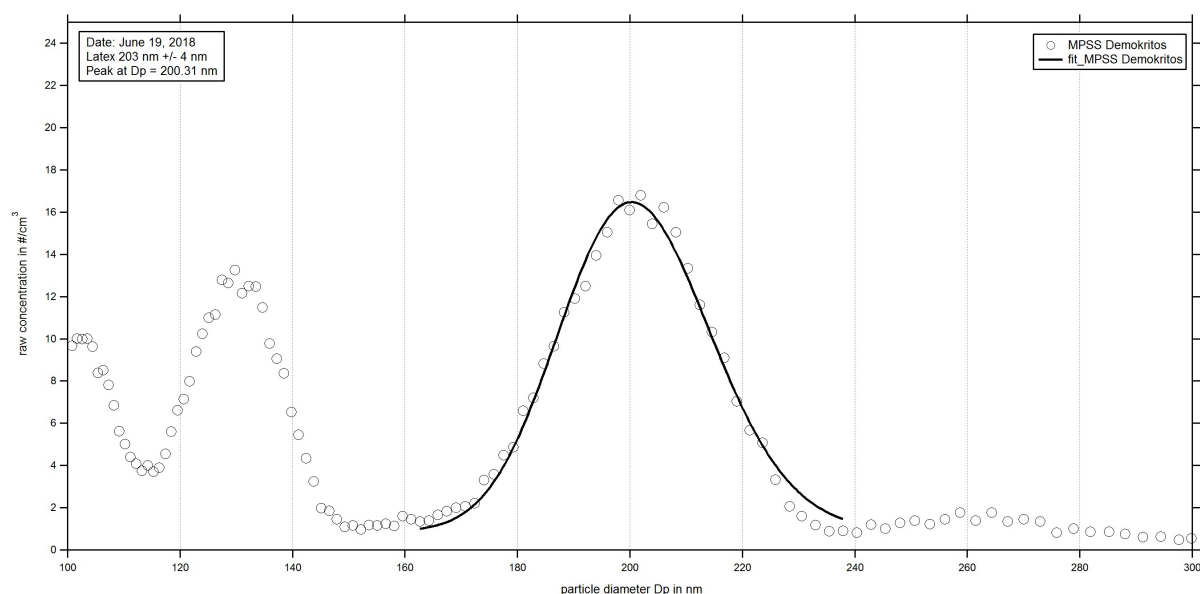


Figure 03: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 19th, 2018.

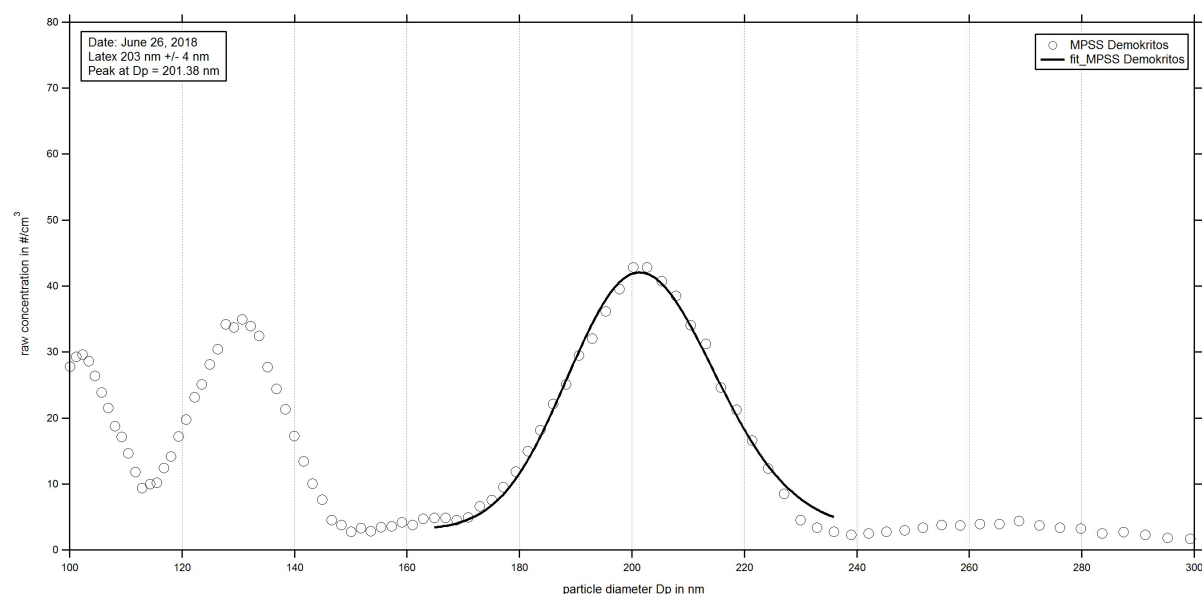


Figure 04: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 26th, 2018.

TROPOS Reference Instruments: Time Series, Correlation and Particle Number Size Distribution

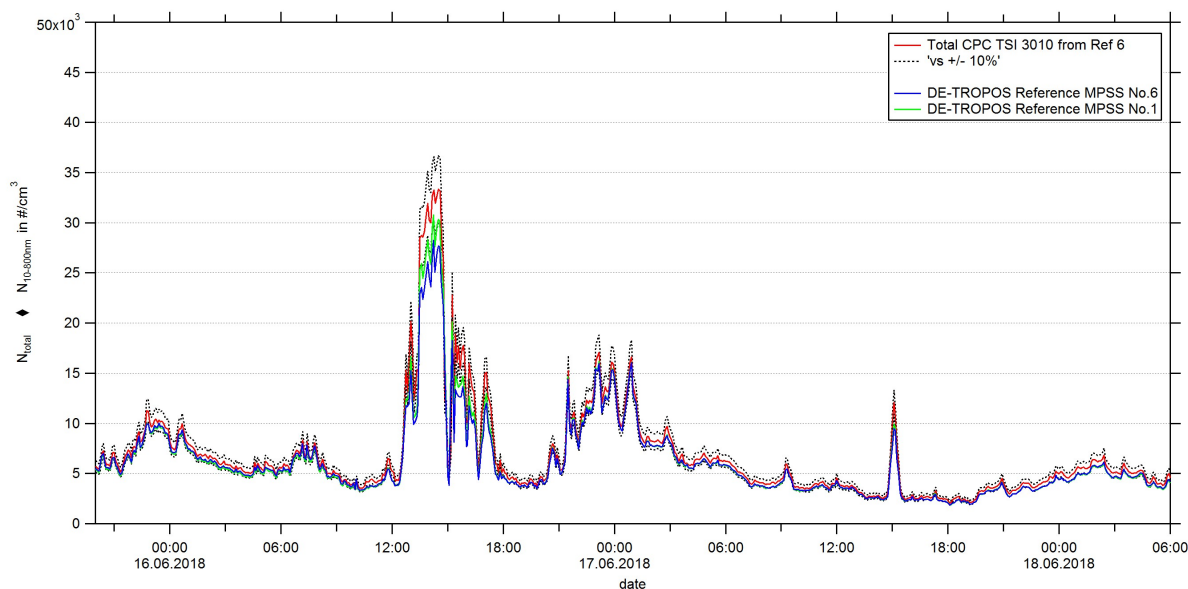


Figure 05: Time series (June 15, 2018 20:00 – June 18, 2018 06:00) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

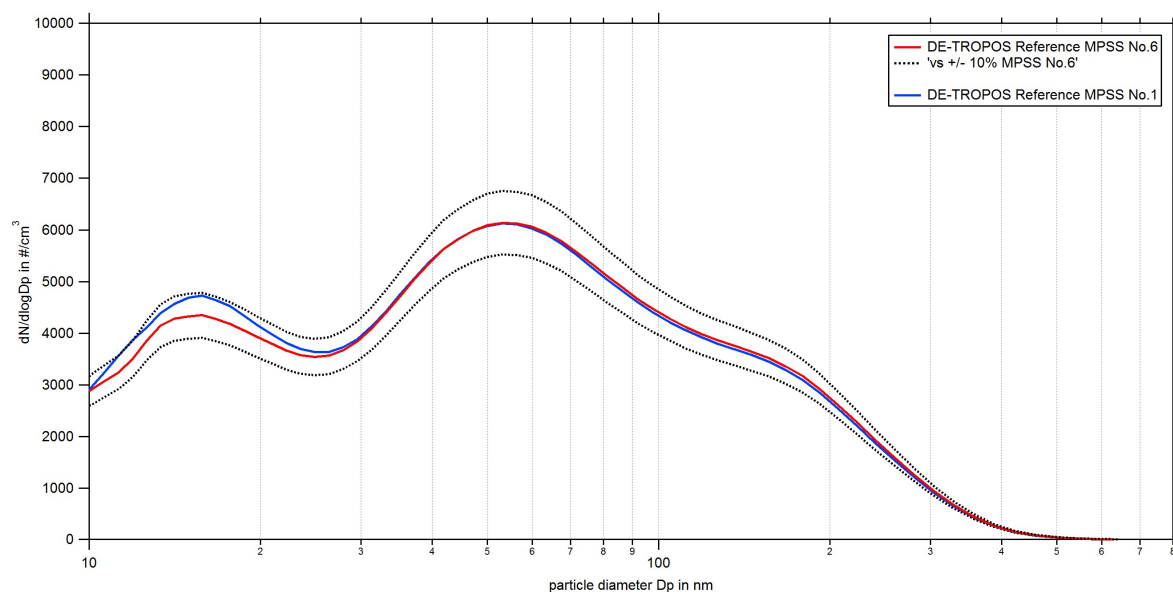


Figure 06: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.6 against TROPOS Reference MPSS No.1 from June 15, 2018 20:00 – June 18, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

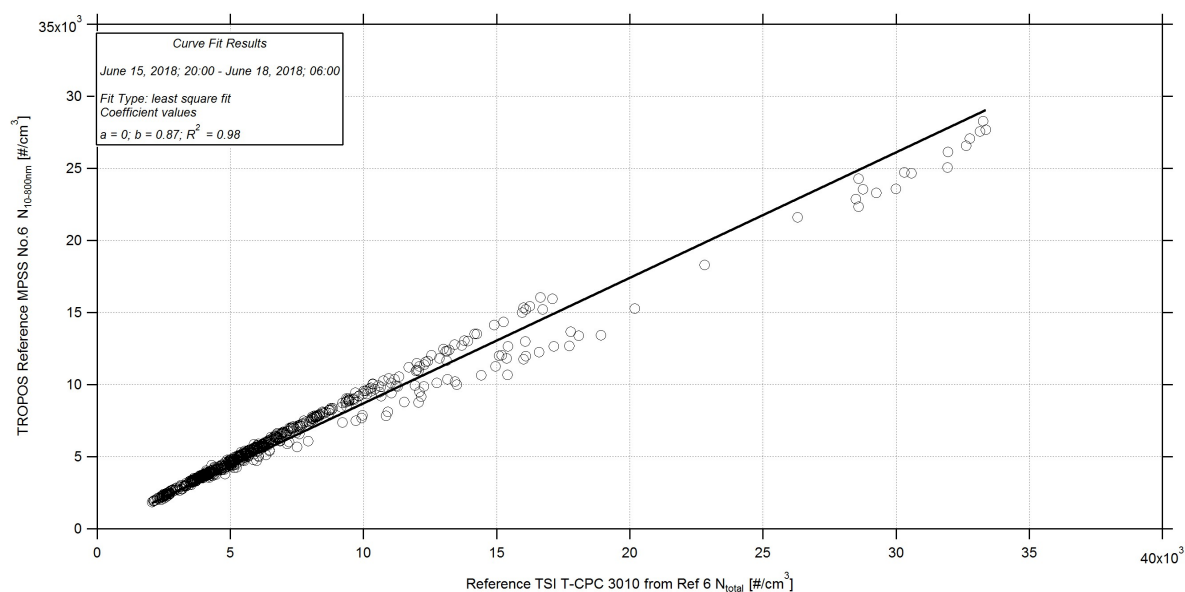


Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and TROPOS Reference MPSS No.6. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

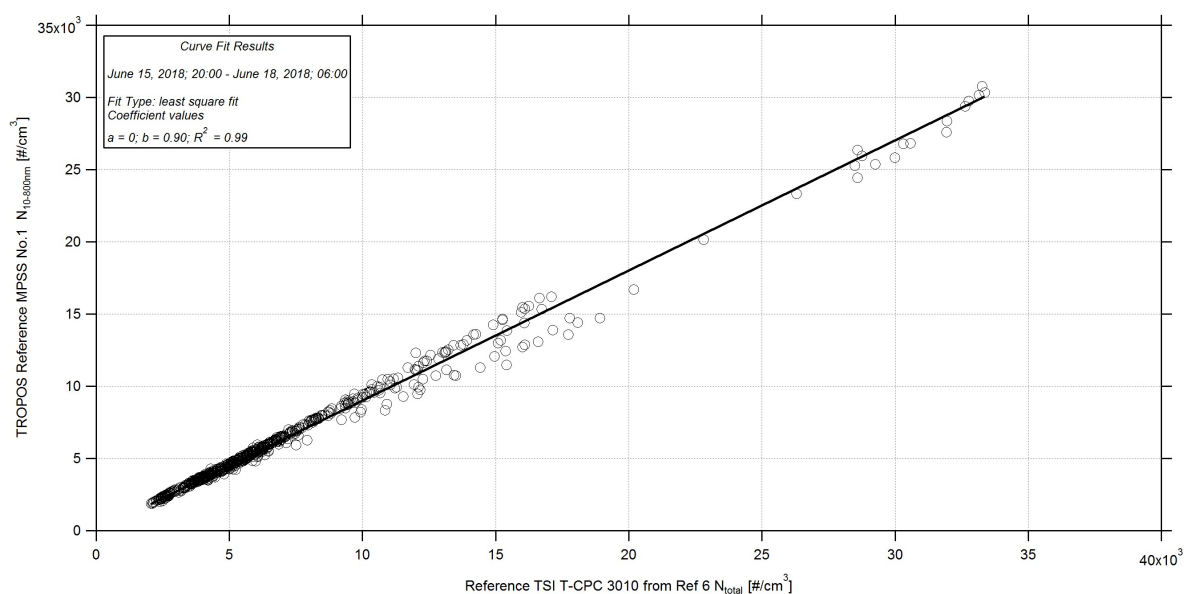


Figure 08: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

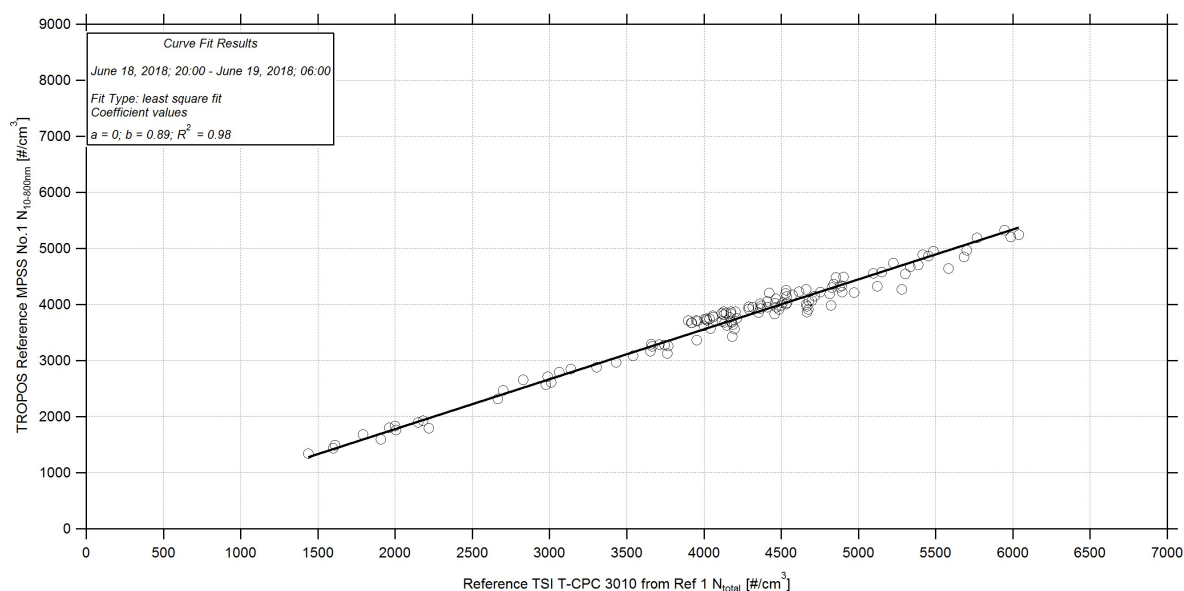


Figure 09: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 1 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

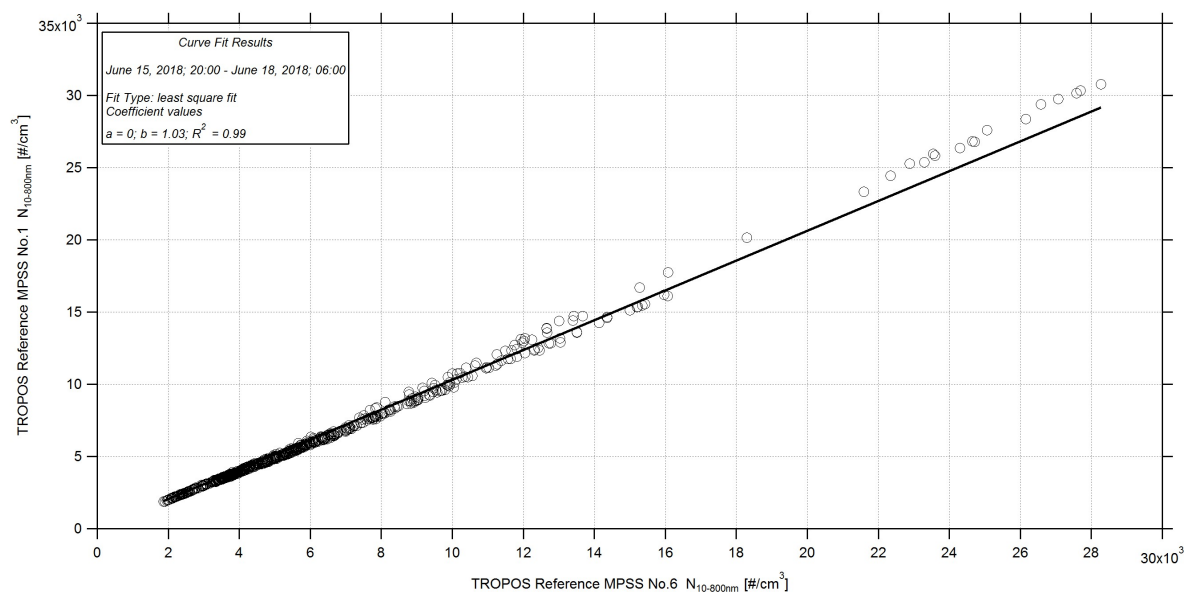


Figure 10: Linear regression between the number concentrations of the TROPOS Reference MPSS No.6 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Pre-Status of the Candidate: Particle Number Size Distribution

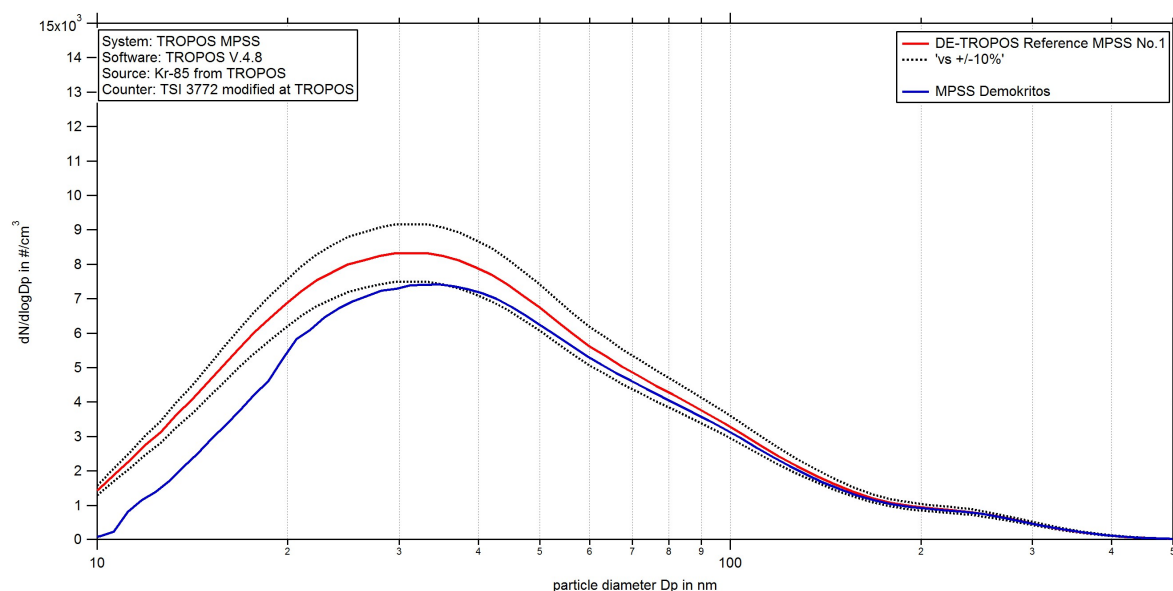


Figure 11: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS Demokritos from June 19, 2018 20:00 – June 20, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Pre-Status of the Candidate: Time Series and Correlation

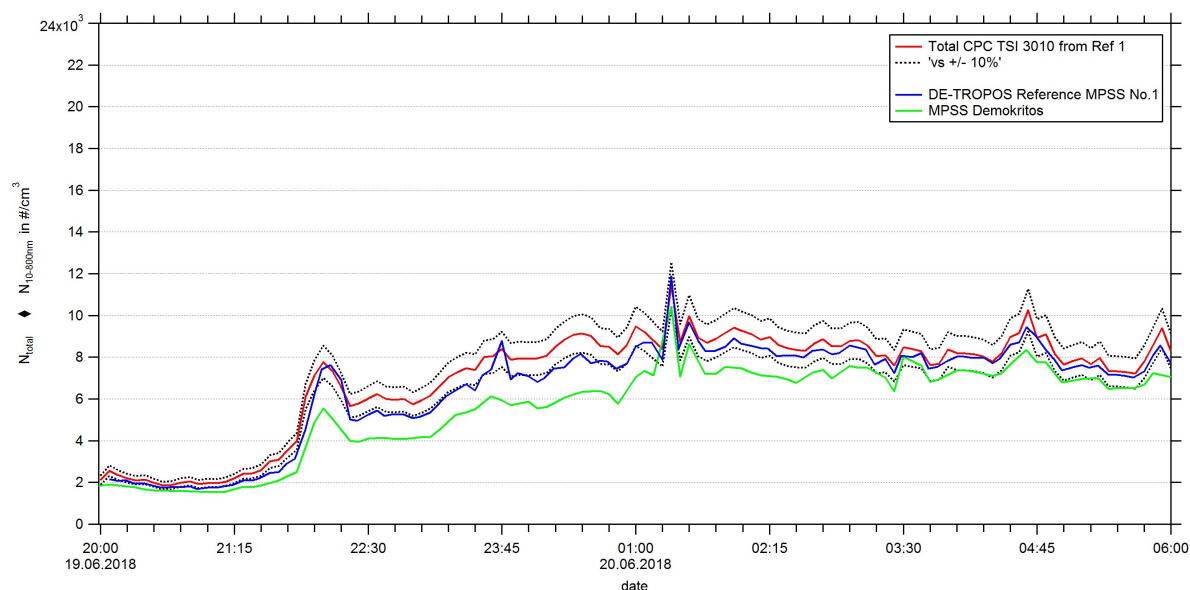


Figure 12: Time series (June 19, 2018 20:00 – June 20, 2018 06:00) of the integrated particle number concentration ($N_{10,800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion and corrections for the candidate were performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

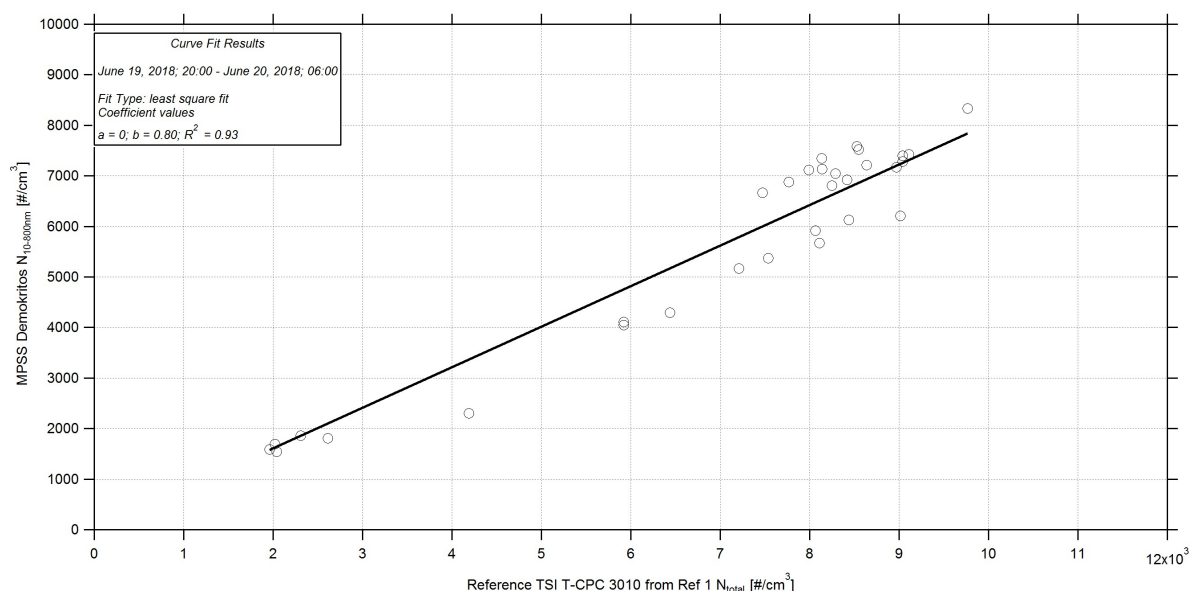


Figure 13: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and MPSS Demokritos (June 19, 2018 20:00 – June 20, 2018 06:00). All corrections are included.

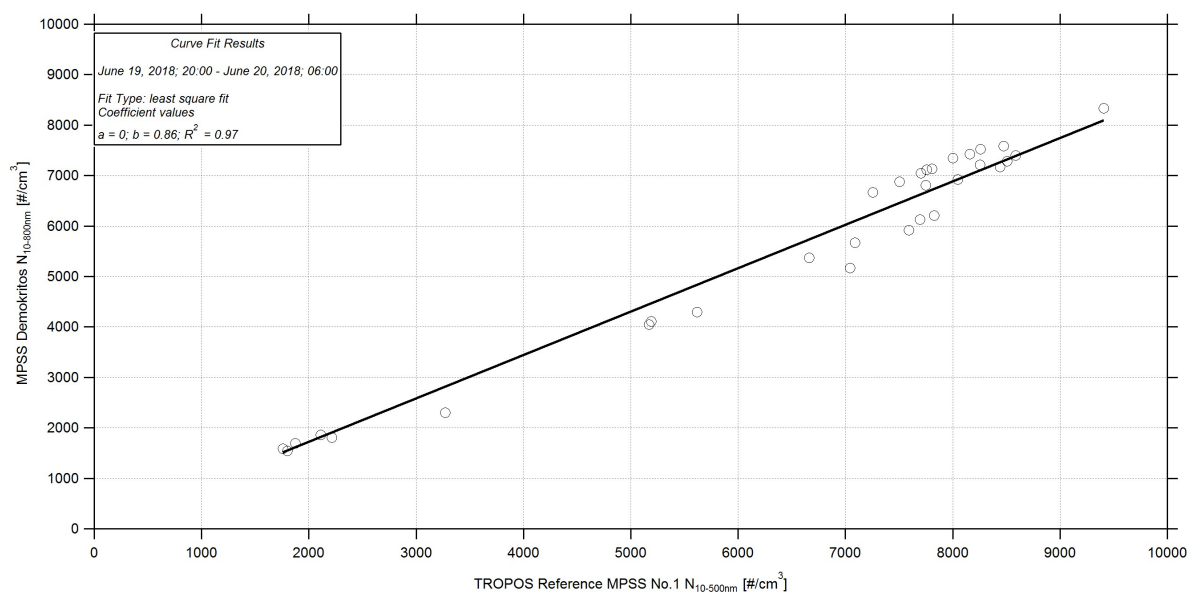


Figure 14: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and MPSS Demokritos. The inversion and corrections for the candidate were performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final-Status of the Candidate: Particle Number Size Distribution

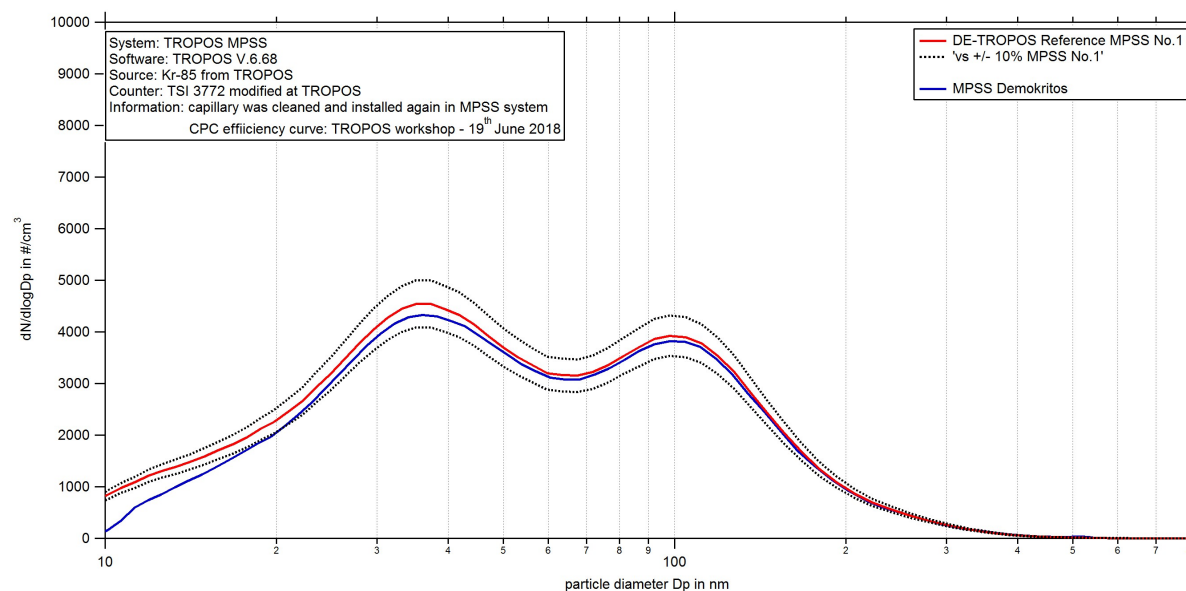


Figure 15: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS Demokritos from June 26, 2018 20:00 – June 27, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final-Status of the Candidate: Time Series and Correlation

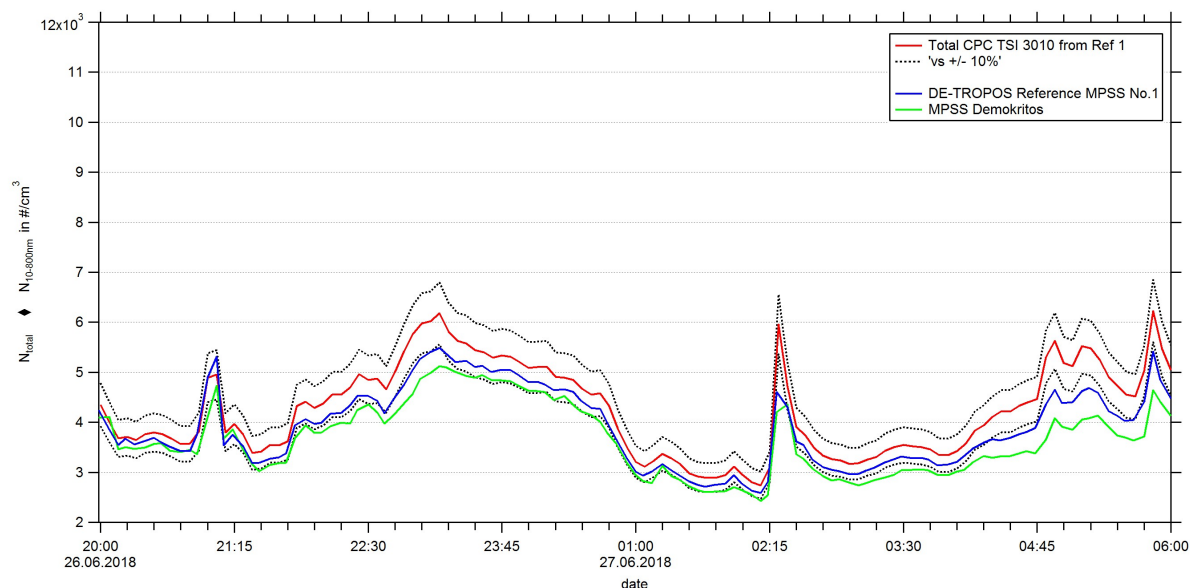


Figure 16: Time series (June 26, 2018 20:00 – June 27, 2018 06:00) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion and correction for the candidate were performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

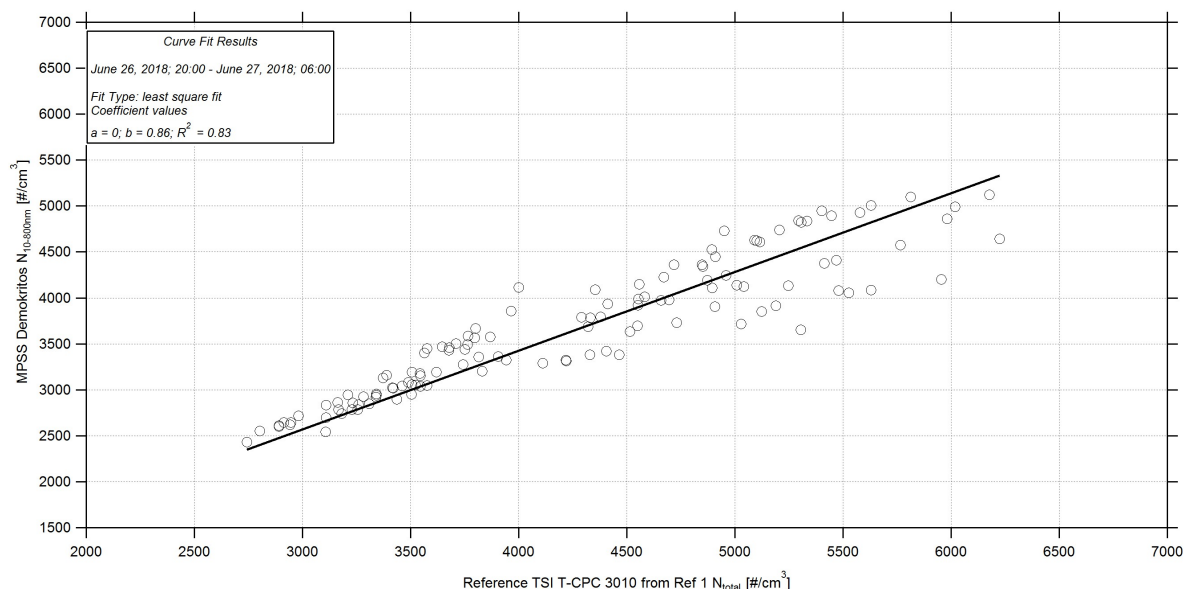


Figure 17: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 1 and MPSS Demokritos (June 26, 2018 20:00 – June 27, 2018 06:00). All corrections are included.

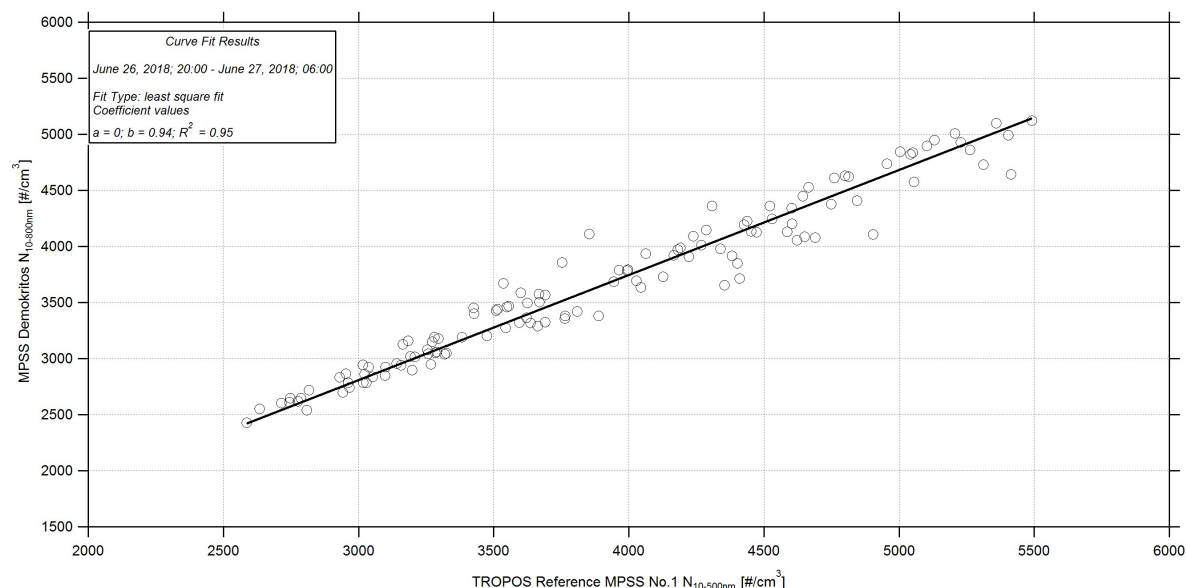


Figure 18: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and MPSS Demokritos (June 26, 2018 20:00 – June 27, 2018 06:00). All corrections are included.

Additional information: Particle Number Size Distributions (HV – not stable)

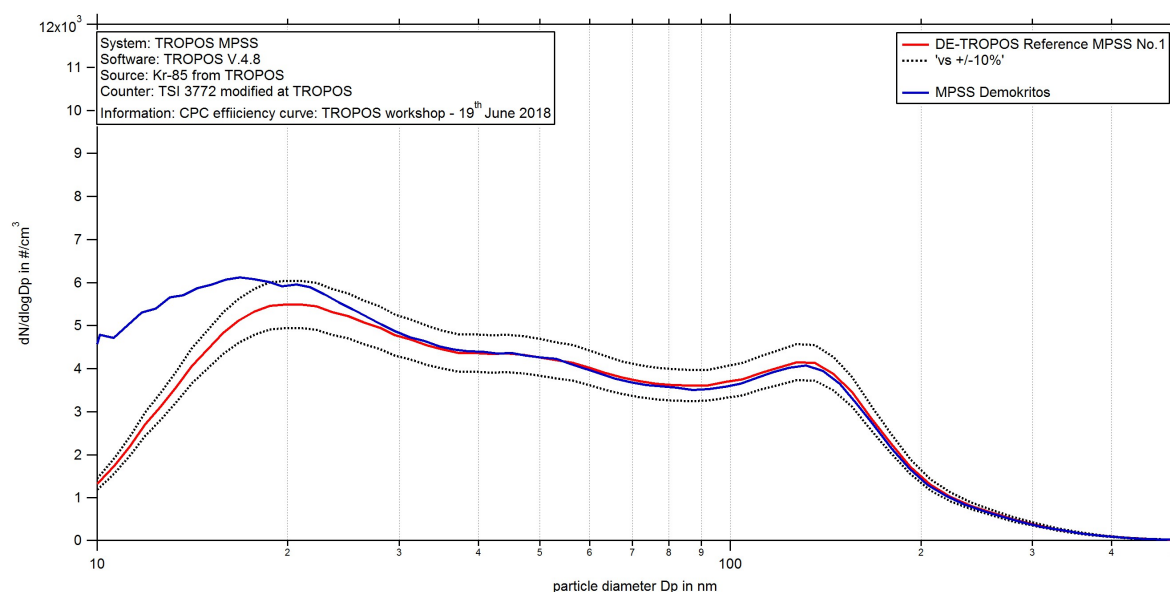


Figure 19: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS Demokritos from June 20, 2018 20:00 – June 21, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

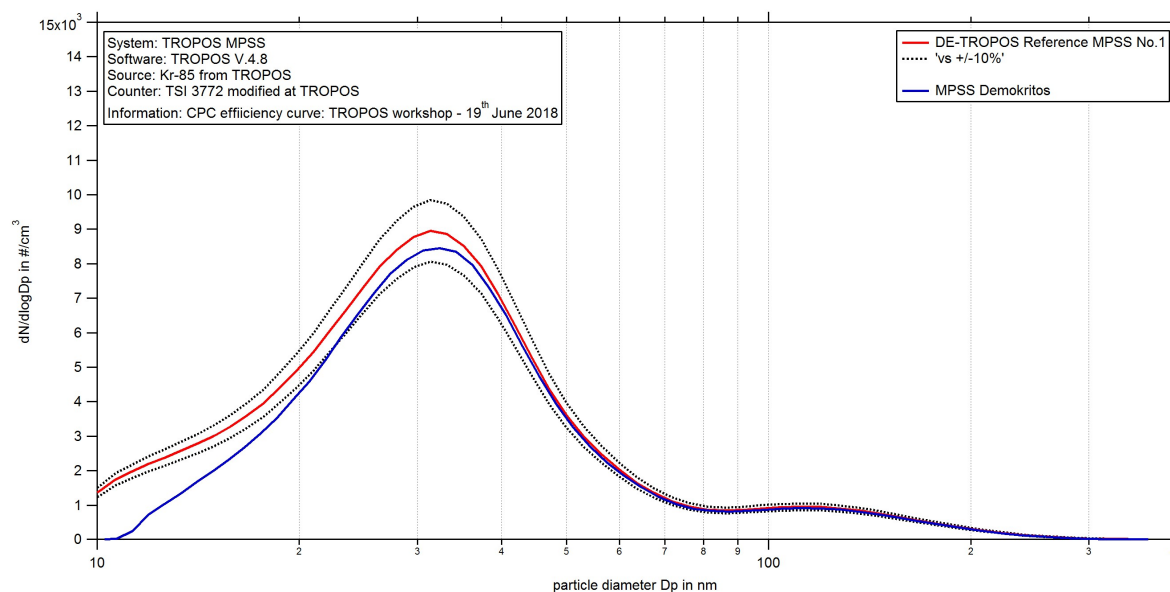


Figure 20: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS Demokritos from June 21, 2018 20:00 – June 22, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

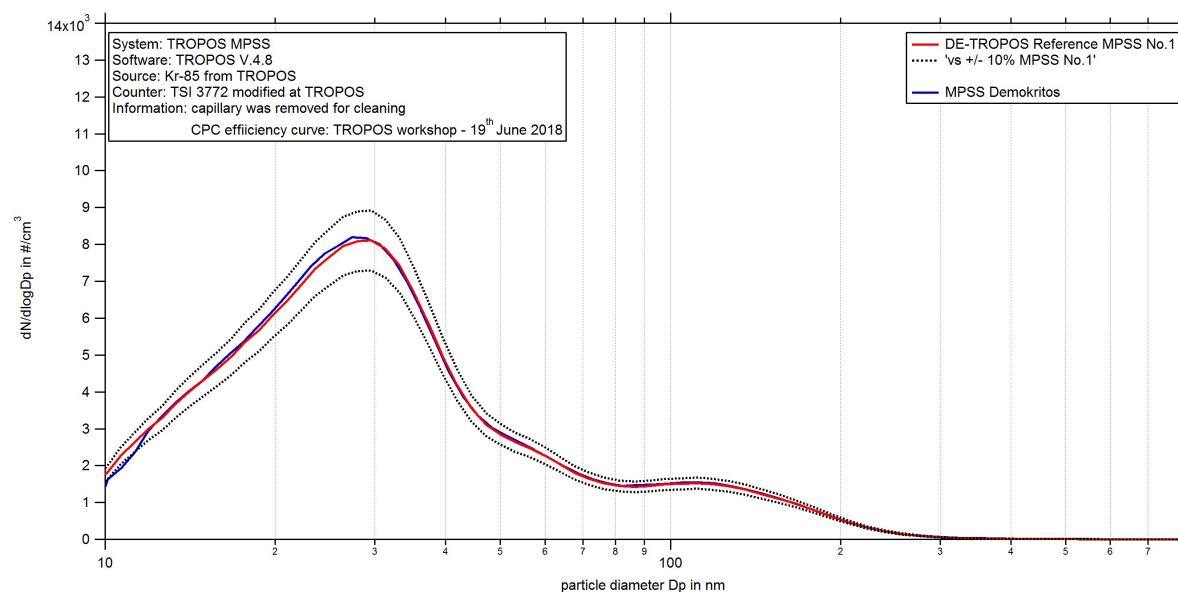


Figure 21: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS Demokritos from June 22, 2018 20:00 – June 23, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.