

Intercomparison of Mobility Particle Size Spectrometers

Project No.: **MPSS-2017-5-1**

Principal Investigator: **Valerie Gos**

Home Institution: **LSCE**

Participant: **Francois Truong**

Candidate: **FR-LSCE**

Made by: **GRIMM**

Counter (SN): **GRIMM , SN: 54161103**

Software: **GRIMM**

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

Comparison period: **October 09, 2017 – October 13, 2017**

Last Intercomparison (with Project No.):

Summary of Intercomparison:

Pre-Status:

The instrument arrived with participant. During the Pre-Status, the performance of the system showed a concentration 15% lower in the time series than the TROPOS Reference Instrument No.4. If you look at the size distribution, the candidate is underestimating the particles in the smaller size range. The PSL check showed a peak shifted to 207.25 nm. It was not possible to bring their own radioactive source, hence, we used a Kr85 source from TROPOS for the whole intercomparison week.

Final-Status:

During the Final-Status, the performance of the system showed a concentration 4% lower than the TROPOS Reference Instrument No.4 by using the TROPOS software for calculating the diffusion losses. However, looking at the size range from 30 up to 800 nm, both evaluation routines are in the +/-10% against the TROPOS Reference Instrument No.4. Using the GRIMM software, the candidate is underestimating the smaller particles which we can attribute to the different method of calculating the diffusion loss corrections from the TROPOS software. TROPOS is using the effective lengths to calculate the diffusion losses for each tube including the flow correction. During the whole workshop, FR-LSCE used a Kr85 source from TROPOS. The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments:

Date of check: October 09, 2017

List of Components	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.4	Candidate
Position	Line 1	Line 2	Line 2
Company	TROPOS	TROPOS	GRIMM
Software	TROPOS	TROPOS	GRIMM/TROPOS
CPC-MPSS	TSI CPC, Model 3772	TSI CPC, Model 3772	5.416
CPC-total	TSI CPC, Model 3010	TSI CPC, Model 3010	5.416
flow ratio	1.0 : 5.0	1.0 : 5.0	0.3 : 3.0
source	Kr85	Ni63	Kr85 from TROPOS
HV power supply	Positive	Positive	Positive
DMA	Hauke medium	Hauke medium	GRIMM
aerosol dryer	✓	✓	
aerosol RH- sensor	✓	✓	
aerosol T-sensor	✓	✓	
sheath RH-sensor	✓	✓	
sheath T-sensor	✓	✓	
Sheath dryer	✓	✓	
pressure sensor	✓	✓	

Status of the instruments: more information are in the CPC Workshop Report

Date of check (Pre-Status): October 09, 2017

<i>CPC status</i>	MPSS		Total CPC	
<i>power/status</i>	LED green	-	-	-
<i>saturator temp</i>	-	°C	-	°C
<i>condenser temp</i>	-	°C	-	°C
<i>optics temp</i>	-	°C	-	°C
<i>cabinet temp</i>	-	°C	-	°C
<i>ambient pressure</i>	-	kPa	-	kPa
<i>orifice pressure</i>	-	kPa	-	kPa
<i>nozzle pressure</i>	-	kPa	-	kPa
<i>laser current</i>	-	mA	-	mA
<i>liquid level</i>	full	-	-	-

Date of check (Final-Status): October 12, 2017

<i>CPC status</i>	MPSS		Total CPC	
<i>power/status</i>	LED green	-	-	-
<i>saturator temp</i>	-	°C	-	°C
<i>condenser temp</i>	-	°C	-	°C
<i>optics temp</i>	-	°C	-	°C
<i>cabinet temp</i>	-	°C	-	°C
<i>ambient pressure</i>	-	kPa	-	kPa
<i>orifice pressure</i>	-	kPa	-	kPa
<i>nozzle pressure</i>	-	kPa	-	kPa
<i>laser current</i>	-	mA	-	mA
<i>liquid level</i>	full	-	-	-

Date of system checks:

<i>date</i>	09.10.2017	10.10.2017	11.10.2017	13.10.2017	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>	0.3	0.3	0.3	0.3	l/min
<i>Zero MPSS</i>	0	0	0	0	#/cm ³
<i>Zero total CPC</i>	-	-	-	-	#/cm ³
<i>PSL 203 nm</i>	-	-	-	-	nm
<i>HV – 0 V</i>	-	-	-	-	V
<i>HV – 5 V</i>	-	-	-	-	V
<i>HV – 100 V</i>	-	-	-	-	V
<i>HV – 1000 V</i>	-	-	-	-	V

Special Information regarding the Candidate:

<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	-	-	TROPOS source
<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	-	-	-

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

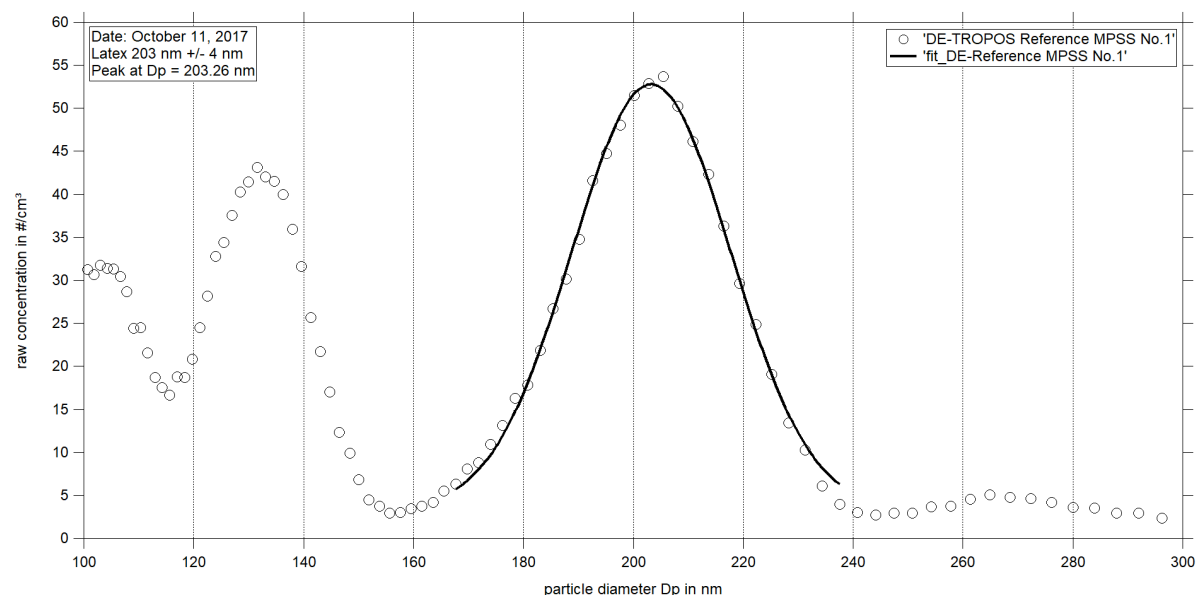


Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on October 11rd, 2017.

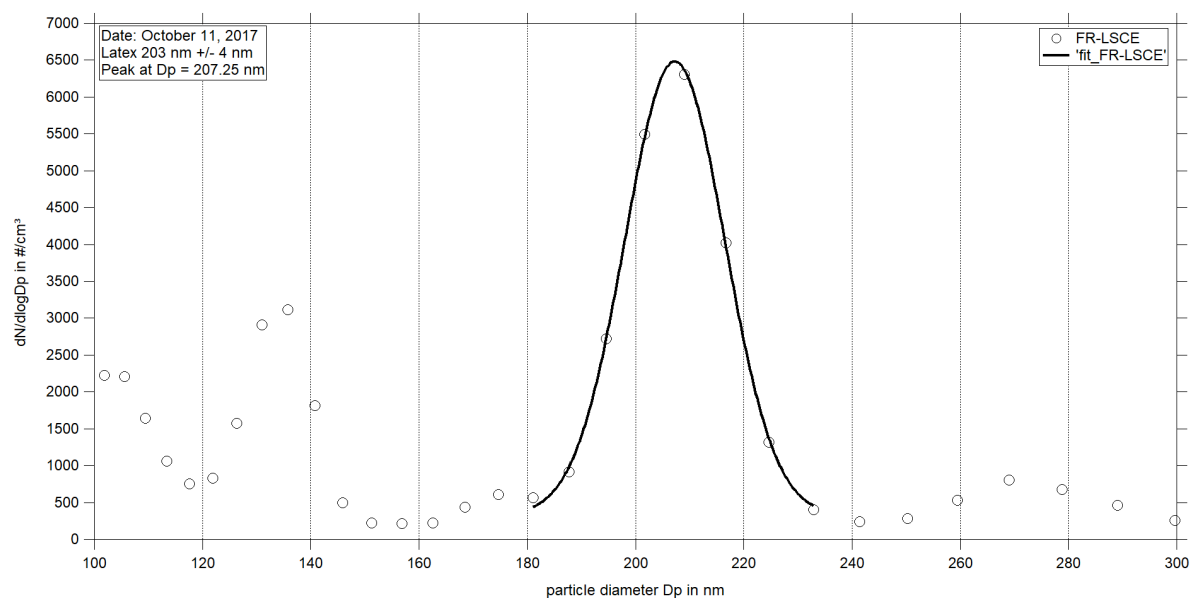


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on October 11rd, 2017.

Status of the TROPOS Reference Instruments: Particle Number Size Distribution

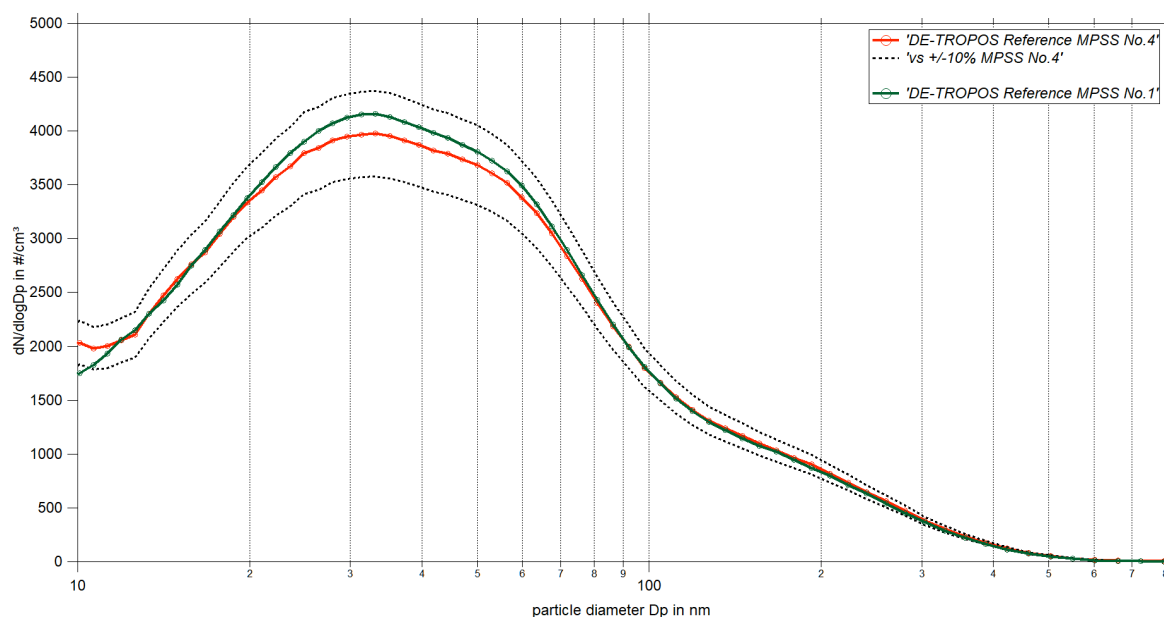


Figure 03: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against TROPOS Reference MPSS No.4 from October 09, 2017 08:00 PM – October 10, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status of the TROPOS Reference Instruments: Time Series

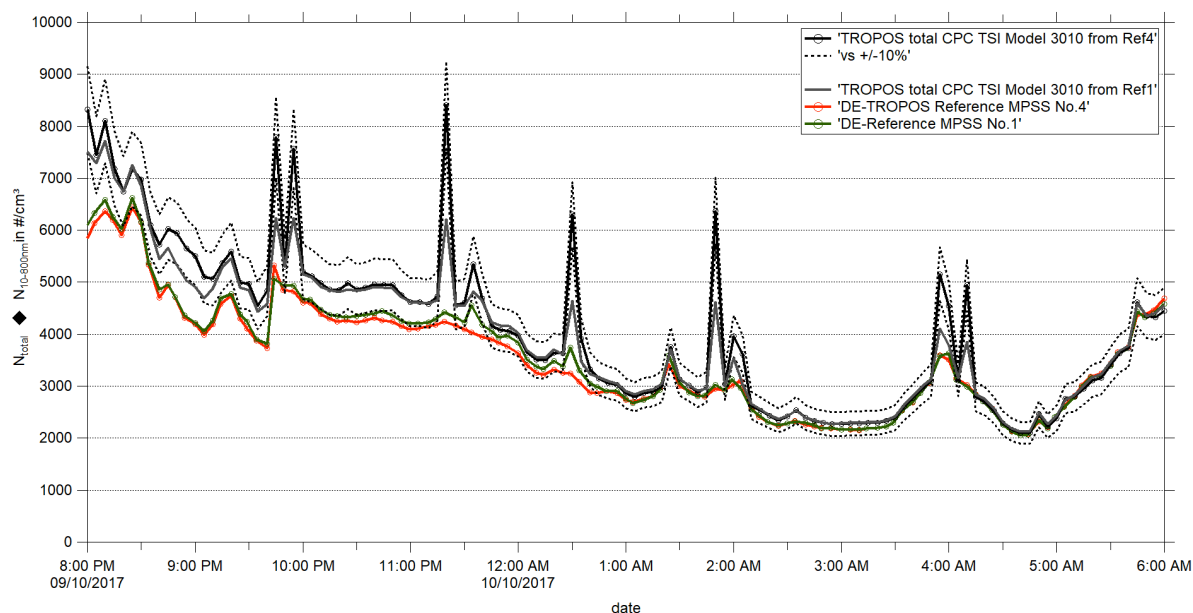


Figure 04: Time series (October 09, 2017 08:00 PM – October 10, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the TROPOS Reference Instruments Correlation

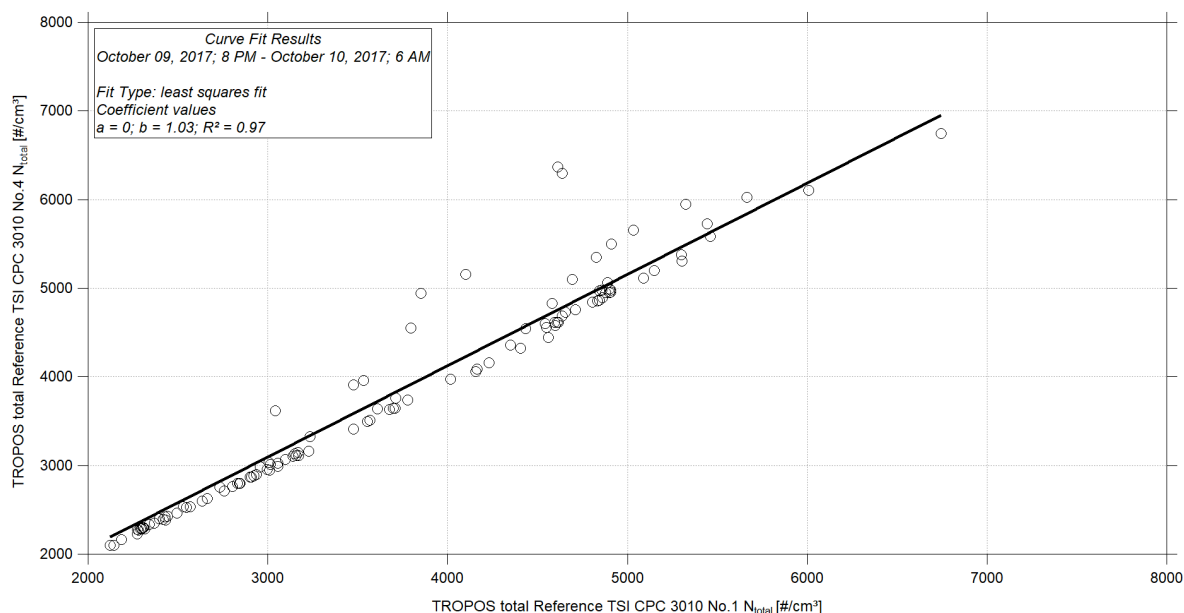


Figure 05: Linear regression between the number concentrations of the TROPOS total Reference TSI CPC Model 3010 No.1 and TROPOS total Reference TSI CPC Model 3010 No.4. Coincidence corrections and CPC flow corrections are included.

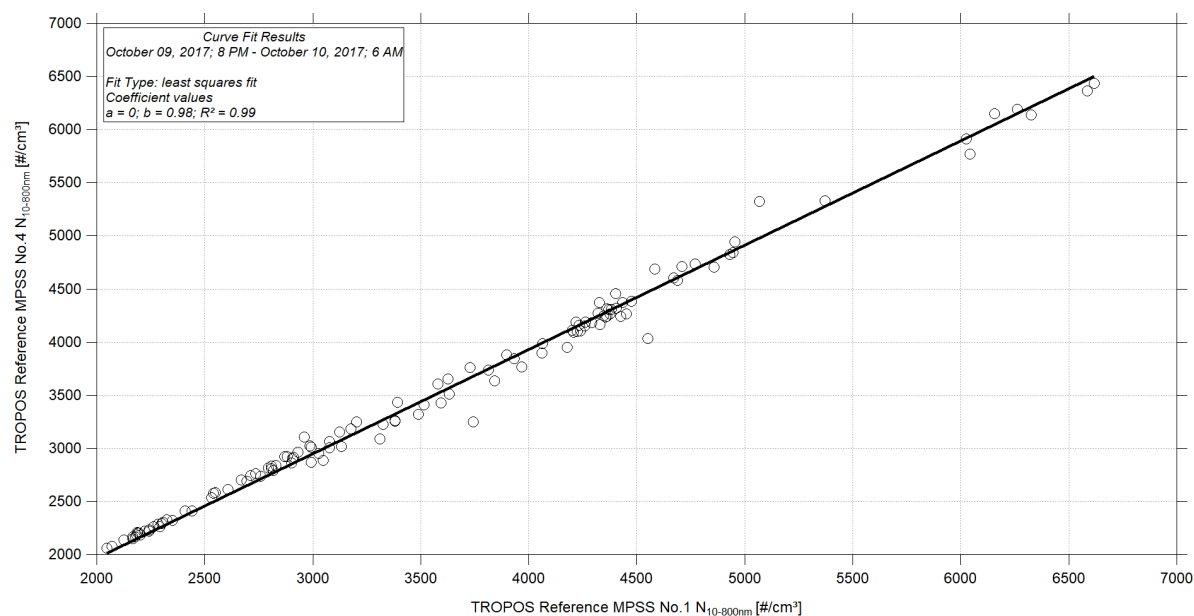


Figure 06: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Pre-Status of the Candidate: Particle Number Size Distribution

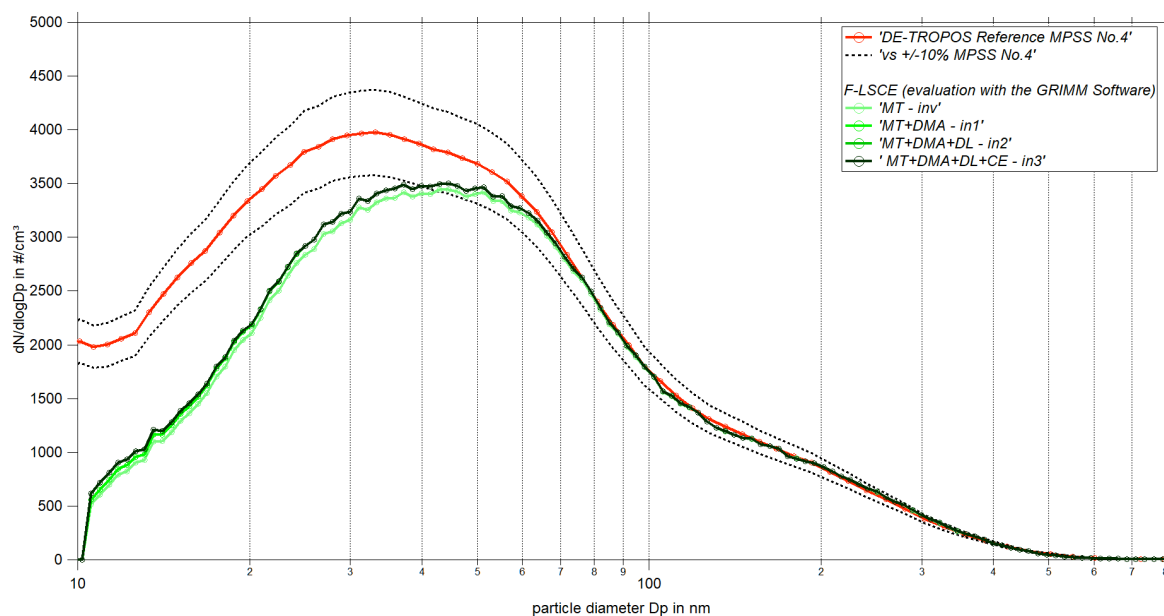


Figure 07: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against FR-LSCE from October 09, 2017 08:00 PM – October 10, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included by using the GRIMM software.

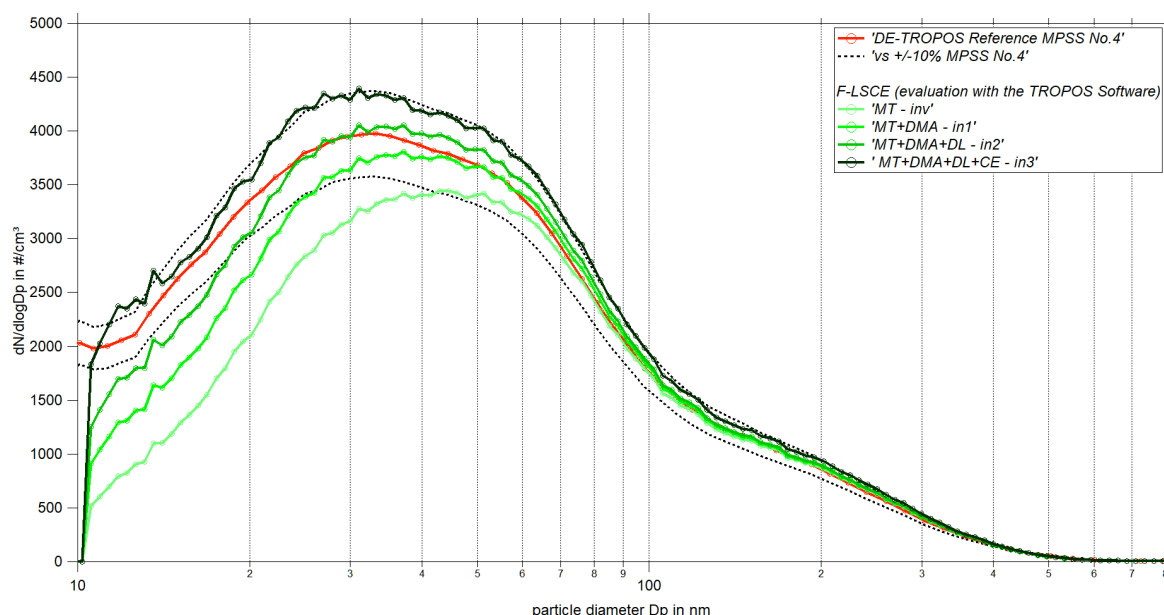


Figure 08: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against FR-LSCE from October 09, 2017 08:00 PM – October 10, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included by using the TROPOS software.

Pre-Status of the Candidate: Time Series

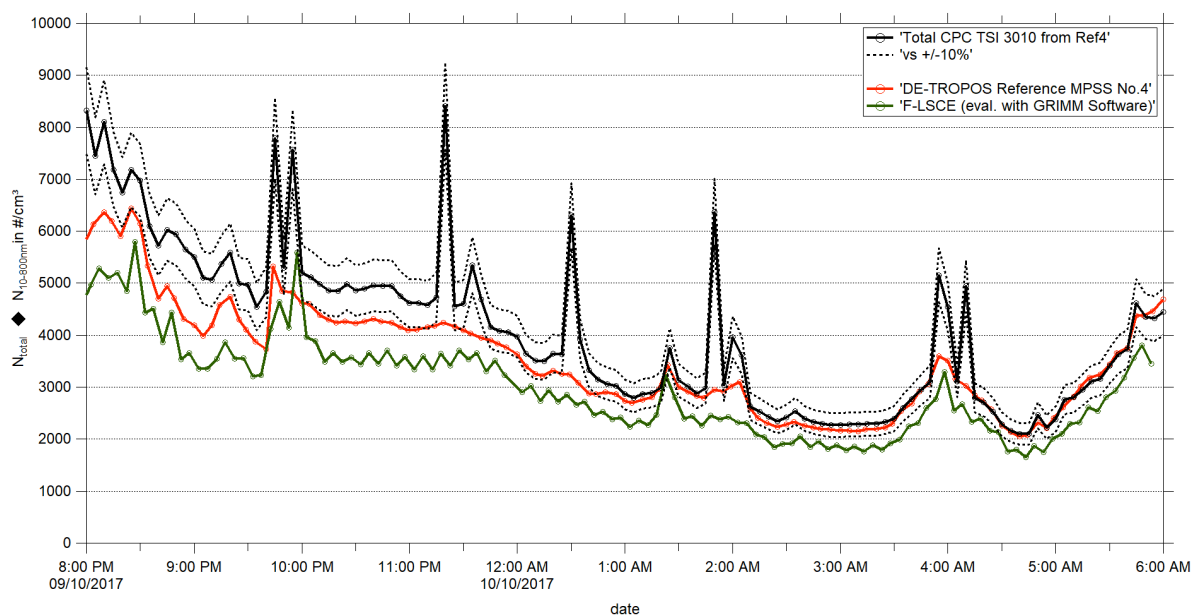


Figure 09: Time series (October 09, 2017 08:00 PM – October 10, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Pre-Status of the Candidate: Correlation

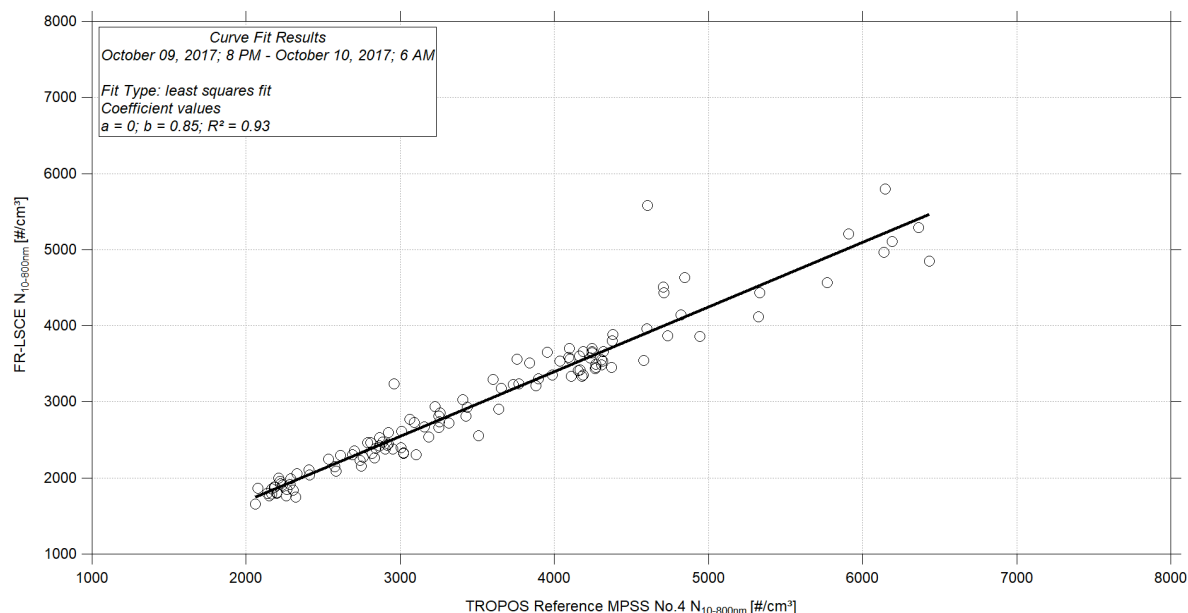


Figure 10: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and FR-LSCE. Multiple charge correction, internal diffusion losses and CPC flow corrections are included by using the GRIMM software.

Final-Status of the Candidate: Particle Number Size Distribution

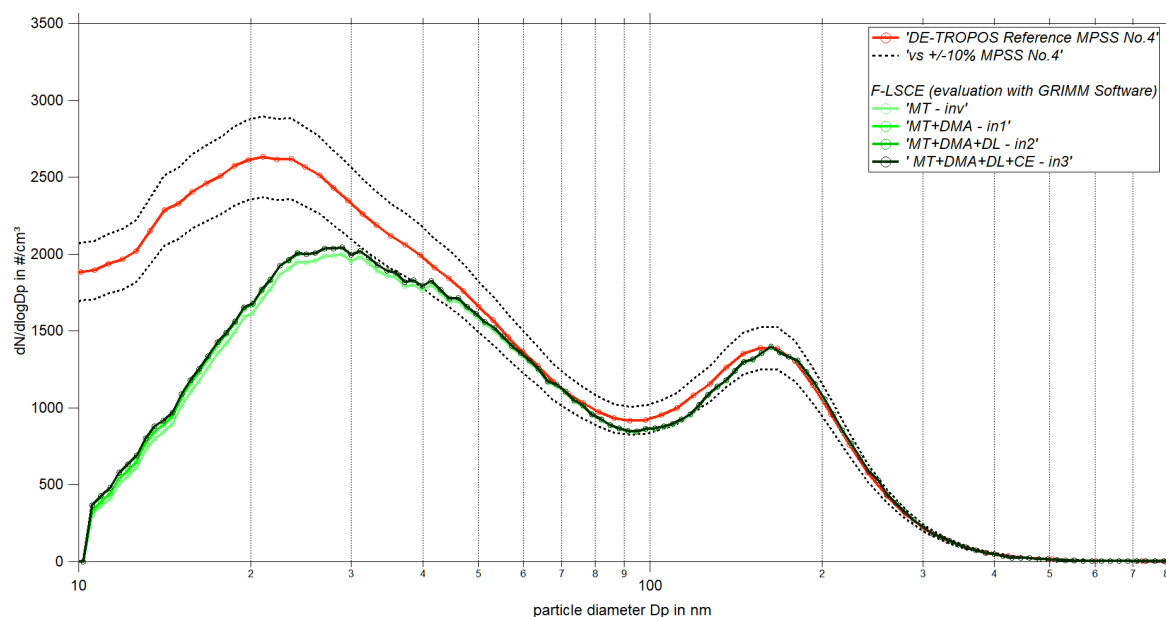


Figure 11: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against FR-LSCE from October 11, 2017 08:00 PM – October 12, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included by using the GRIMM software.

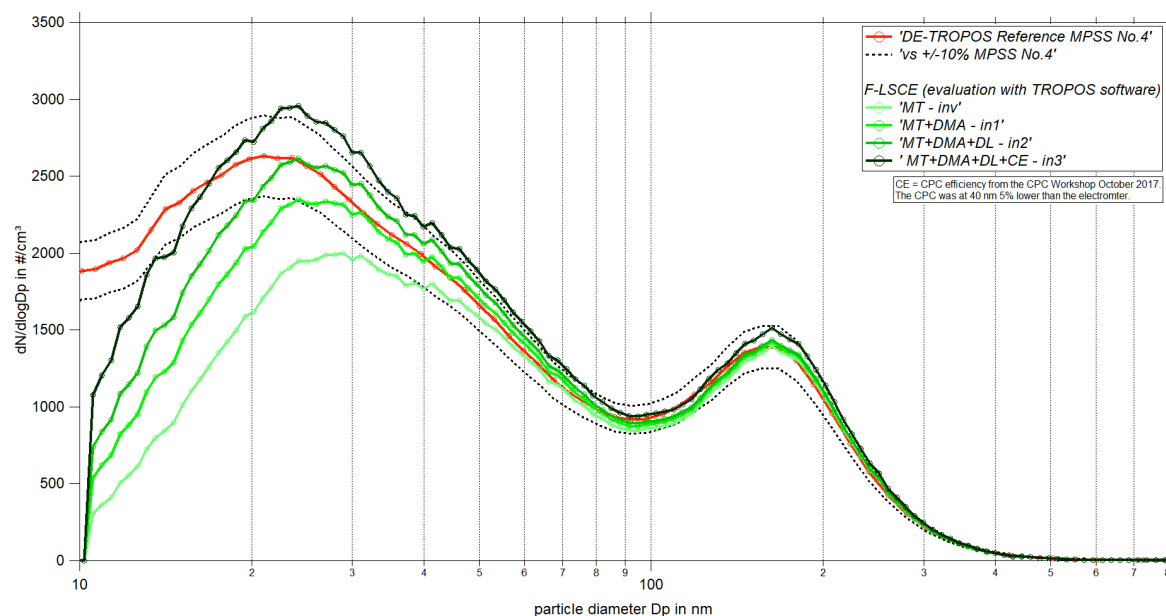


Figure 12: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against FR-LSCE from October 11, 2017 08:00 PM – October 12, 2017 06:00 AM. Internal diffusion losses and CPC efficiency are included by using the TROPOS software. The CPC efficiency is from the CPC workshop in October 2017.

Final-Status of the Candidate: Time Series

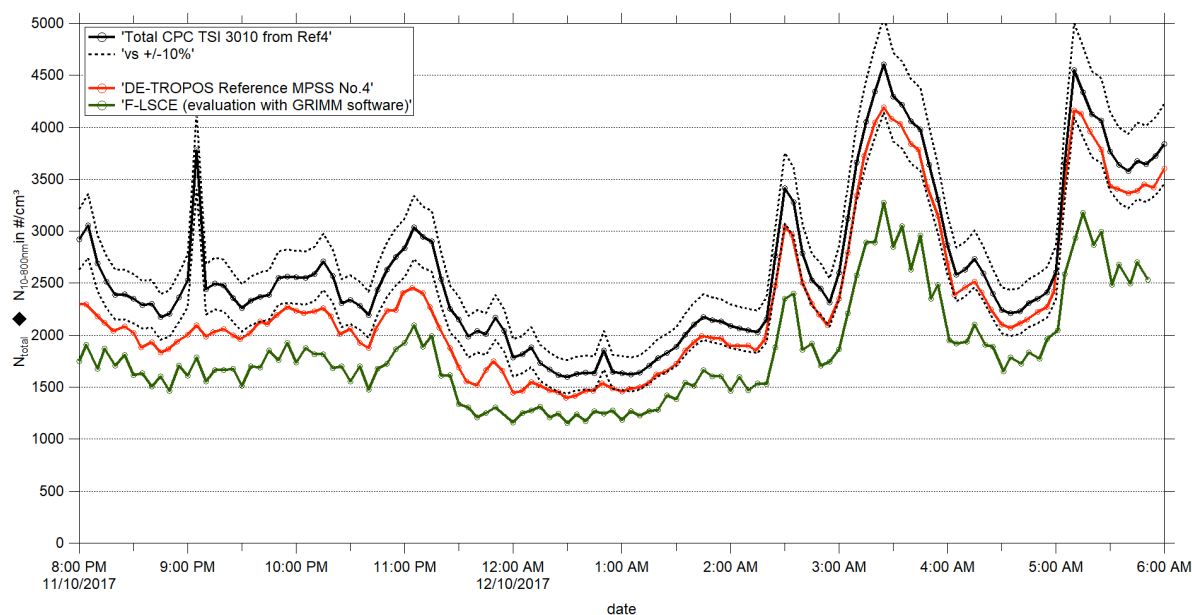


Figure 13: Time series (October 11, 2017 08:00 PM – October 12, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included by using GRIMM evaluation software.

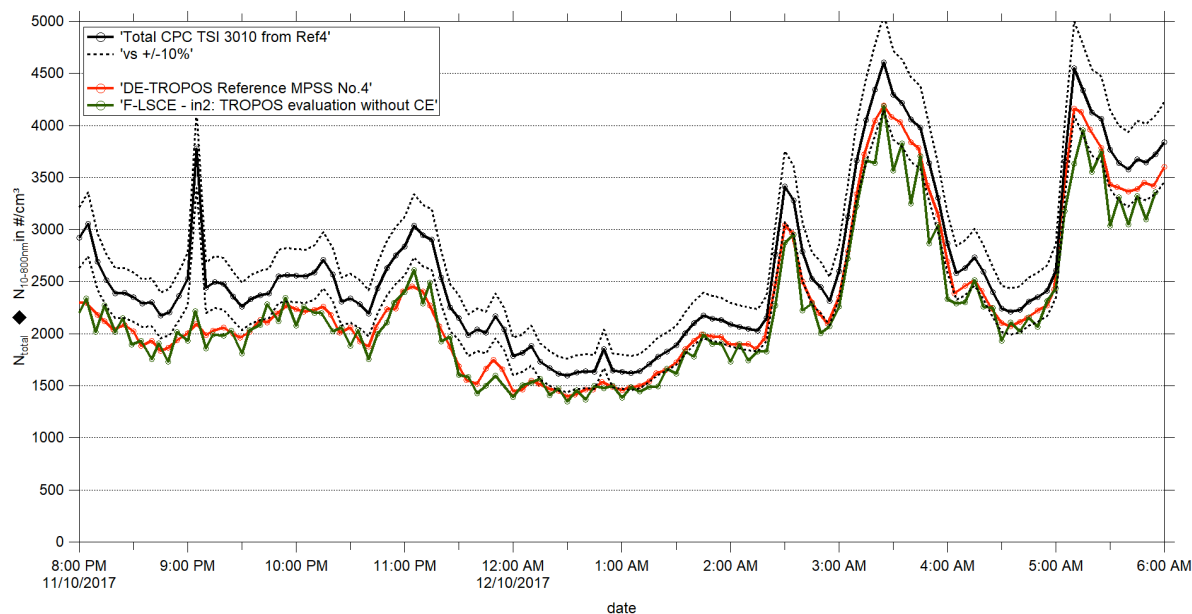


Figure 14: Time series (October 11, 2017 08:00 PM – October 12, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Internal diffusion losses and CPC flow corrections are included by using TROPOS evaluation software.

Final-Status of the Candidate: Correlation

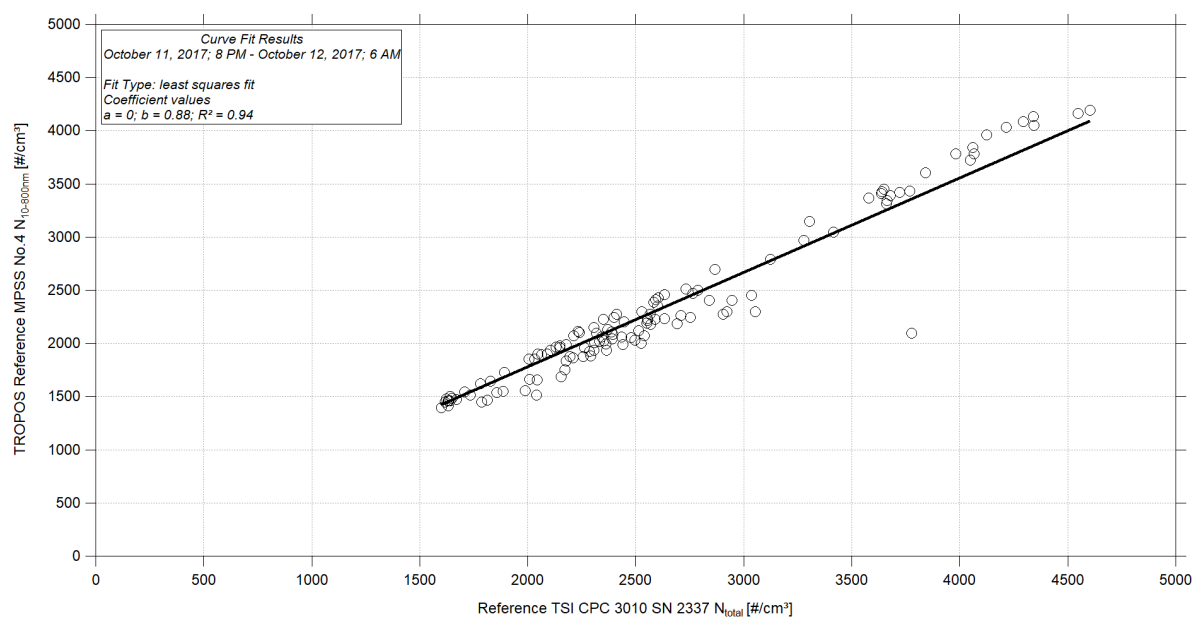


Figure 15: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.4 (October 11, 2017 08:00 PM – October 12, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

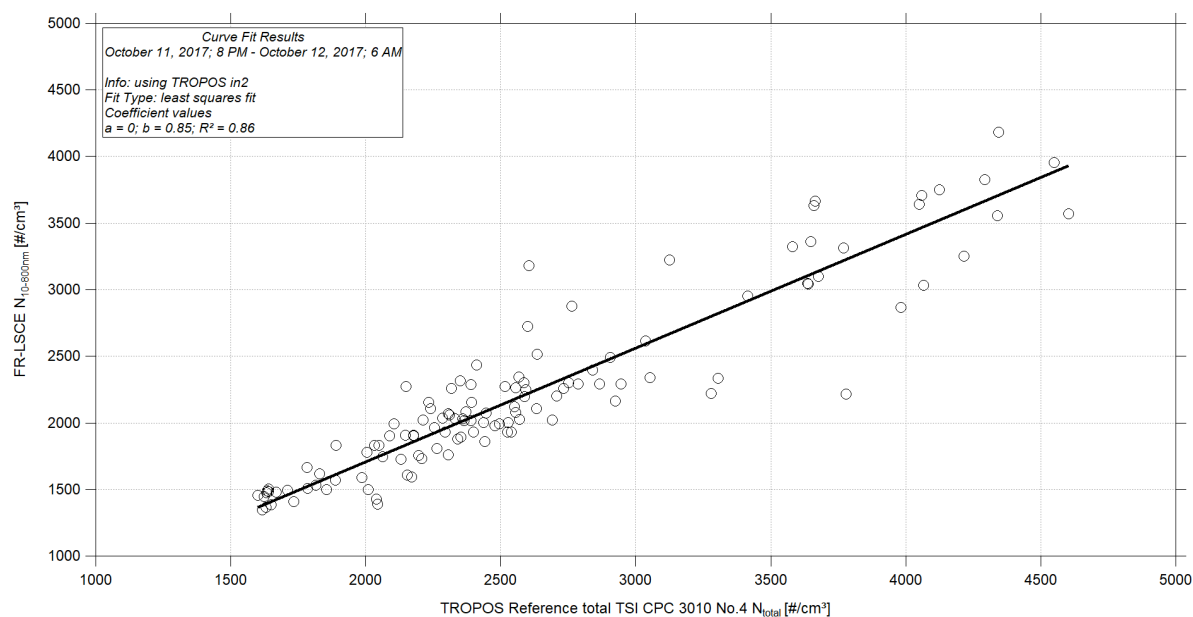


Figure 16: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and FR-LSCE (October 11, 2017 08:00 PM – October 12, 2017 06:00 AM). Internal diffusion losses and CPC flow corrections are included by using the TROPOS software. The CPC efficiency curve is not included.

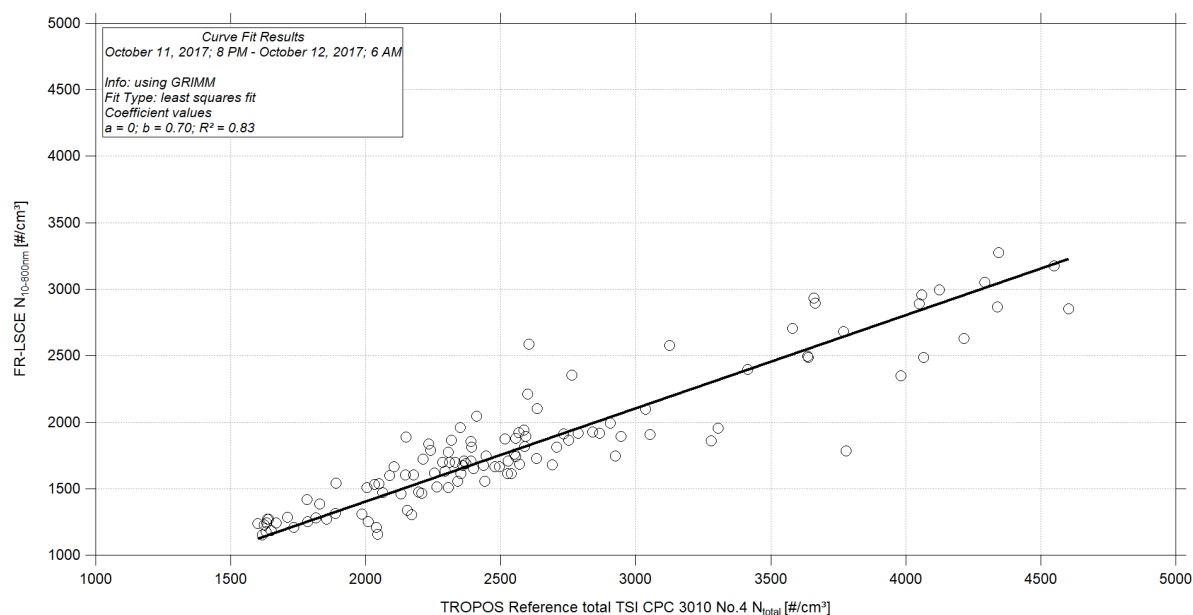


Figure 17: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and FR-LSCE (October 11, 2017 08:00 PM – October 12, 2017 06:00 AM). Internal diffusion losses and CPC flow corrections are included by using the GRIMM software.

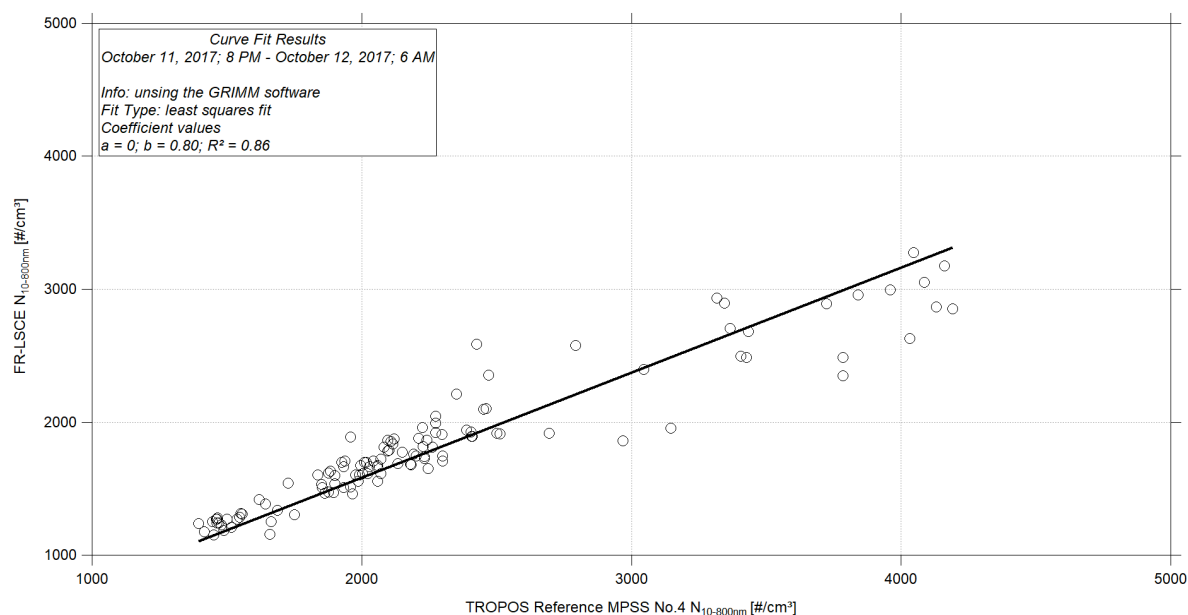


Figure 18: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and FR-LSCE (October 11, 2017 08:00 PM – October 12, 2017 06:00 AM). Internal diffusion losses and CPC flow corrections are included by using the GRIMM software.

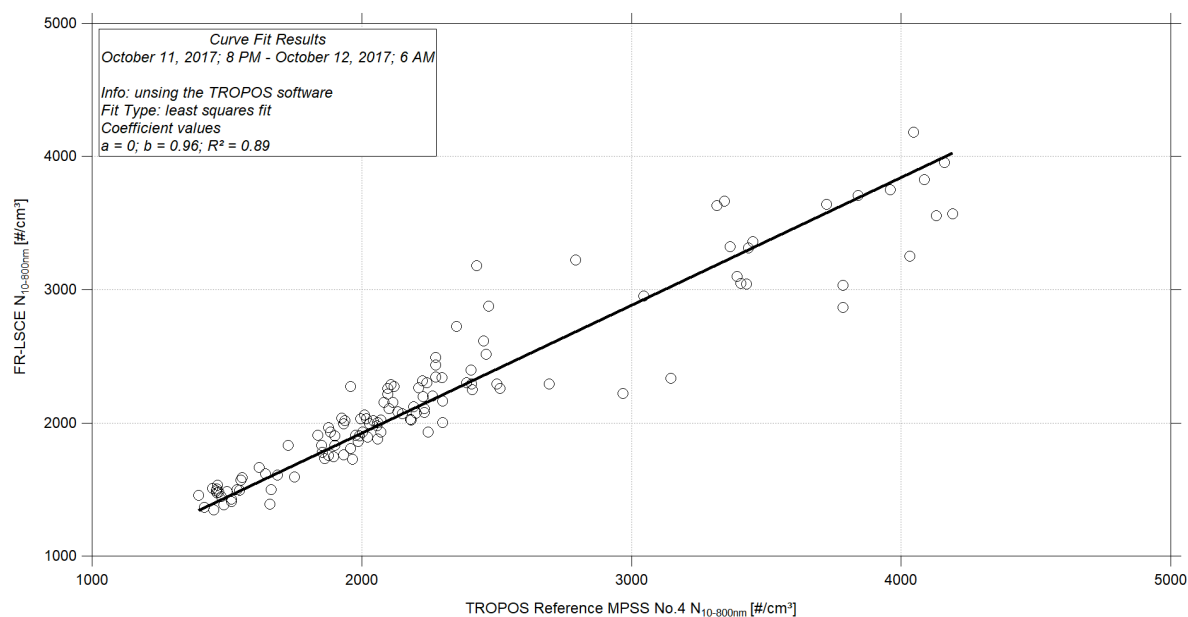


Figure 19: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and FR-LSCE (October 11, 2017 08:00 PM – October 12, 2017 06:00 AM). Internal diffusion losses and CPC flow corrections are included by using the TROPOS software.