

Presented by

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Prepared by

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HAIC/HIWC Science Team Meeting

9/03/2015

PSD Dataset

HAIC – High Altitude Ice Crystals

Content

- Short (historical) review of intercomparison exercise
- Few results of the intercomparison exercise Sept-2014 & Jan-2015
- Updated hypothesis for the PSD dataset
- Interim PSD dataset

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Historical review

- Intercomparison exercise launched after Darwin campaign (for flight 23 image data of 2D-S and PIP distributed to EC, UI, LaMP (UBP/CNRS)).
- Paris, 09-2014:
 1. limited first intercomparison (without concertation and some resulting misunderstandings) of counts, concentrations, and also of PSD.
 2. Way forward: harmonize processing algorithms following a step by step approach

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Historical review

- Clermont 13/14-Jan-2015 & Toulouse 16-Jan-2015:
 1. Exercise not finished, so far good consensus on extrapolation of partial images, sample distance/volume (overload!) calculation.
 2. Decision taken to
 - (i) speed up the processing, applying all lacking corrections at once (within 2-4 weeks) and then intercompare and
 - (ii) in parallel to continue (for 6 months & more...) time consuming detailed study of individually applied corrections

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Historical review

- Webex 12-Feb-2015: Result of speeded up processing (apply all corrections at once)
 1. Statement: HAIC intercomparison exercise produces best agreement we have ever seen so far !
 2. Decision:
 - (i) Release preliminary PSD dataset, thereby explaining precisely applied processing and related limitations of dataset to avoid misunderstandings.
 - (ii) Continue detailed study of individual corrections.

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Historical review

At a glance: objectives & status

After Paris meeting 09-2014:

Objectif 1 - Identify the differences and their main sources in calculation results

Extrapolation of partial images

Computation of width in sample volume

Computation of sample distances

Objectif 2 - Come to a consensus about the processing algorithms which will be used for the HAIC-HIWC data analysis

Following Korolev and Sussman (2000)

Improvement of the overload computation

➔ Check of the counts and concentrations before applying corrections ✓

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Historical review

At a glance: objectives & status

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Objectif 1 - Identify the differences and their main sources in calculation results

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Following Korolev and Sussman (2000)

Improvement of the overload computation

→ Check of the counts and concentrations before applying corrections ✓

After Clermont/Toulouse meetings Jan-2015:

Objectif 3 - Apply all corrections at once and study PSD and MMDs dispersion. If reasonable agreement → distribute a preliminary version of PDS/MMDs dataset

Objectif 4 - continue time consuming detailed step by step processing

Interarrival time treatment (shattering)

Out of focus particles

Rejection criteria (splashing and noise removal)

Coincident images

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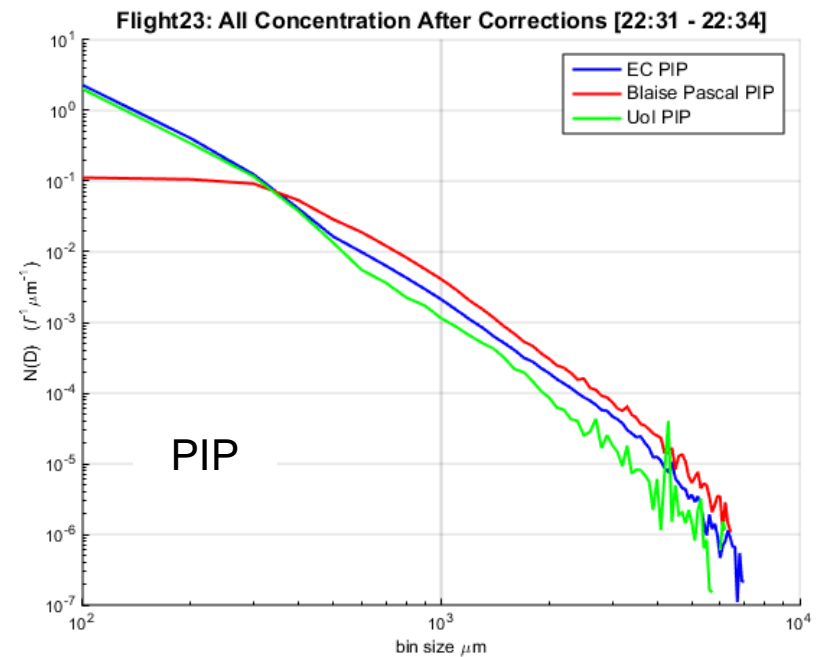
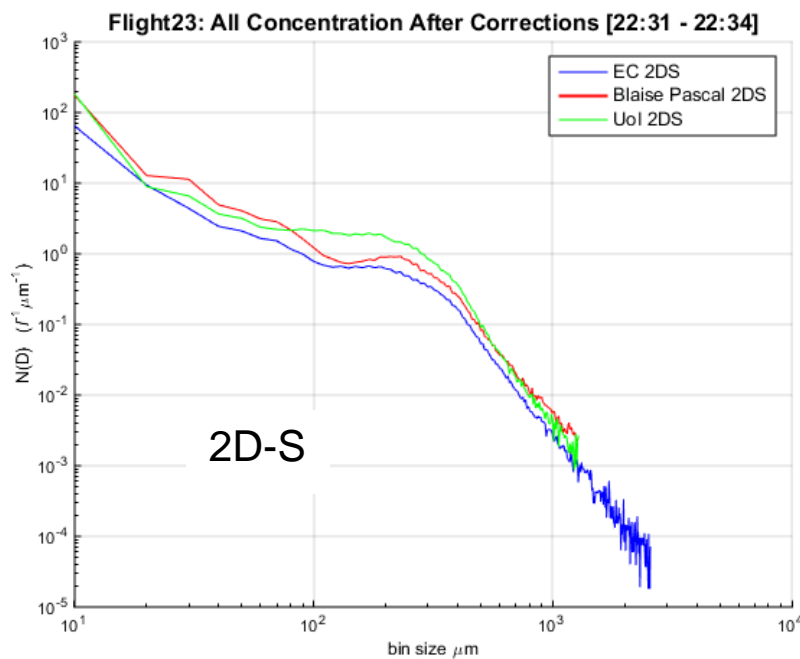
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Few results: intercomparison exercise

Intercomparison exercise :

- Flight 23
- 3 teams : Environnement Canada / University of Illinois / UBP-LaMP

Initial status ([Paris, 09/2014](#)) : example of PSD (mean over 3 min) in a convective part of flight 23



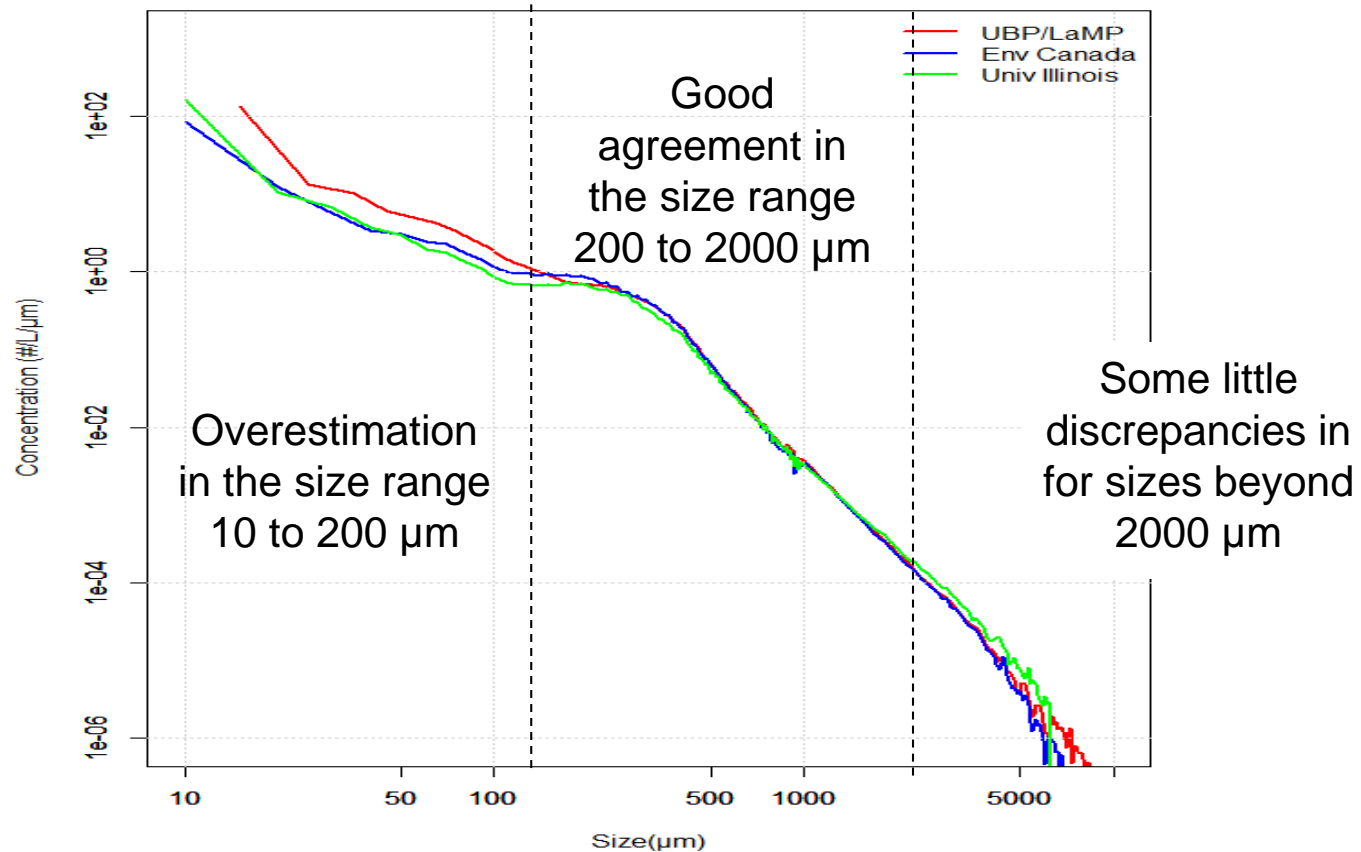
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Intercomparison exercise

Intercomparison exercise :

- Flight 23
- 3 teams : Environnement Canada / University of Illinois / UBP-LaMP

Intermediate status (01/2015) : exemple of composite PSD (mean over 3 min) in a convective part of flight 23

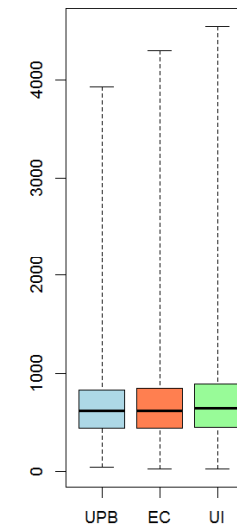
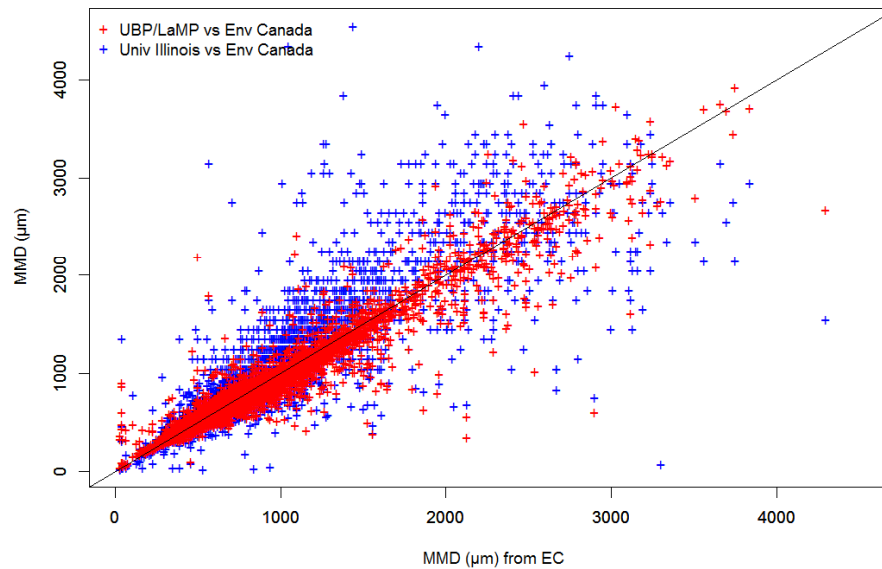
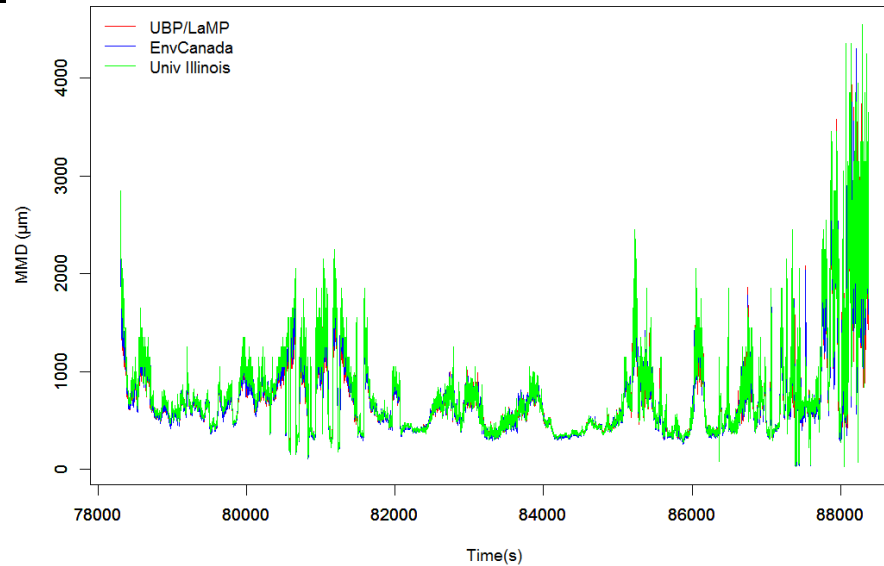


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Intercomparison exercise

Impact on MMDs:

vol 23



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Intercomparison exercise

Impact on MMDs:

$$\text{absolute error} = |\text{data B} - \text{data A}|$$

$$\text{relative absolute error}(\%) = 100 \frac{|\text{data B} - \text{data A}|}{\text{data A}}$$

Mean values	Relative absolute error (%)			Absolute error (µm)		
	EC/UBP	UI/UBP	EC/UI	EC/UBP	UI/UBP	EC/UI
No IKP threshold	7.34	10.71	12.16	50.91	99.48	103.5
TWC > 0 g/m3	6.28	8.99	10.35	38.82	73.84	77.41
TWC > 0.01 g/m3	6.06	8.91	10.17	38.06	73.32	76.61
TWC > 0.1 g/m3	4.7	7.85	9.23	32.17	70.1	71.71
TWC > 0.2 g/m3	4.09	7.12	8.66	27.57	64.12	65.18
TWC > 0.5 g/m3	3.7	6.83	8.39	23.01	57.59	58.98

➔ Decision to release an interim dataset produced with the same set of hypothesis as for the intercomparison

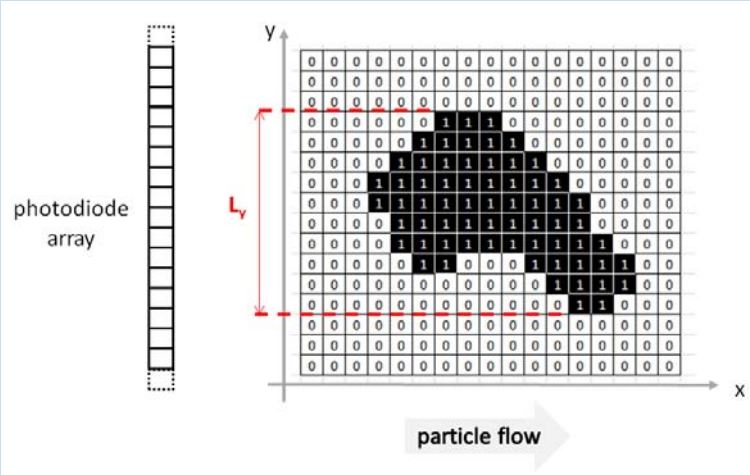
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Updated hypothesis for the interim dataset

Characteristics	Choice for the interim dataset
Size definition	<p>L_y, particle dimension along the photodiode array</p> 
Pixel size resolution of raw images	10 μm for 2D-S, 100 μm for PIP
Channel (2D-S probe)	Vertical channel except for flight 22
Size bin	217 bins, 10 μm resolution between 15 and 995 μm and 100 μm resolution between 1050 and 12750 μm
Composite PSD compilation	Cross over size = 1000 μm

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Updated hypothesis for the interim dataset

Characteristics	Choice for the interim dataset
Time resolution	5s
Treatment of truncated images	Following Korolev and Sussman (2000) → Keep all images
	
Out of focus images	Following Korolev (2007)
Splashing/Shattering removal	Cut off determined at 1s resolution, criteria of 3 neighbouring particles
Noisy pixel removal	Following Lawson (2011)
Coincident multiple particles single images	Particles separated
Applied mass-size relationship used for L_y dimension	Brown and Francis (1995)

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Interim PSD dataset

File format : text file

Size bin (μm)

time	15	25	35	45	55	65	75	85	95	105
10473	2516.55624	0.9696006	0.2308036	0.1237184	0.1071737	0.07022489	0.05969522	0.05008407	0.03015037	0.02852795
10478	3177.27554	2.3234364	1.19977113	0.36971033	0.17136668	0.09479376	0.13448287	0.1159248	0.05210542	0.01688805
10483	1386.52918	0.8324825	0.3507546	0.19016326	0.06287207	0.04968104	0.06406792	0.05742934	0.04216433	0.0219357
10488	1543.54338	0.7626764	0.4426665	0.17075589	0.04692042	0.03289405	0.0318725	0.03207957	0.03011194	0.01885946
10493	1264.72631	1.079731	0.44906178	0.13195848	0.06177609	0.04665876	0.04548294	0.04009897	0.03378066	0.02392671
10498	1325.93694	0.7704717	0.38335736	0.13455499	0.06578289	0.02227691	0.03471408	0.03842138	0.02480066	0.01105571
10503	1304.48809	0.58763163	0.26677499	0.11135449	0.03990212	0.02186293	0.02143807	0.02326788	0.02624861	0.01185545
10508	1270.04406	0.6445057	0.27409483	0.06844577	0.03534171	0.01623902	0.02543901	0.03296818	0.03343576	0.02250994
10513	1536.53282	0.7696812	0.26153674	0.12033744	0.08281694	0.0302839	0.03524634	0.03644575	0.028959	0.01355824
10518	2457.77922	2.7786011	0.17731825	0.07383239	0.06096769	0.03121116	0.03324309	0.03135801	0.02096477	0.02025851
10523	6561.75423	2.482871	0.4960418	0.1848652	0.30296	0.28009898	0.02420697	0.04031466	0.04530863	0.01669681
10528	7548.77874	2.4773444	0.8753714	0.2792933	0.5482229	0.46300709	0.02222842	0.02523364	0.01280182	0.00437738
10533	5253.11748	5.4475677	0.3578896	0.25247683	0.35803039	0.25335046	0.02756829	0.04168386	0.02260797	0.01662503
10538	6191.87975	4.6851143	0.4503609	0.2438892	0.34013832	0.22648064	0.0349152	0.03899899	0.03320453	0.01736104
10543	6326.41951	6.1081616	0.9776203	0.2842423	0.4886779	0.37550656	0.07694778	0.04088595	0.04557448	0.02444796
10548	7697.46706	8.0517408	1.7350511	1.2008071	0.2596367	0.24852827	0.11596931	0.0362802	0.01561898	0.02841836
10553	7075.28392	6.7563162	0.8786263	0.3419976	0.4387039	0.22760072	0.03492575	0.04635952	0.04308072	0.02253541
10558	8026.04231	6.2555542	2.3868406	1.1154233	0.2022433	0.09928528	0.0691266	0.03782255	0.02364515	0.02910771
10563	8099.90945	6.6250091	1.7273311	1.189036	0.5317804	0.25020767	0.03277978	0.03585945	0.02607444	0.01936518
10568	7681.96143	4.5988956	2.0957066	1.7845382	0.3027735	0.11749648	0.02450994	0.04323725	0.03563995	0.01316043

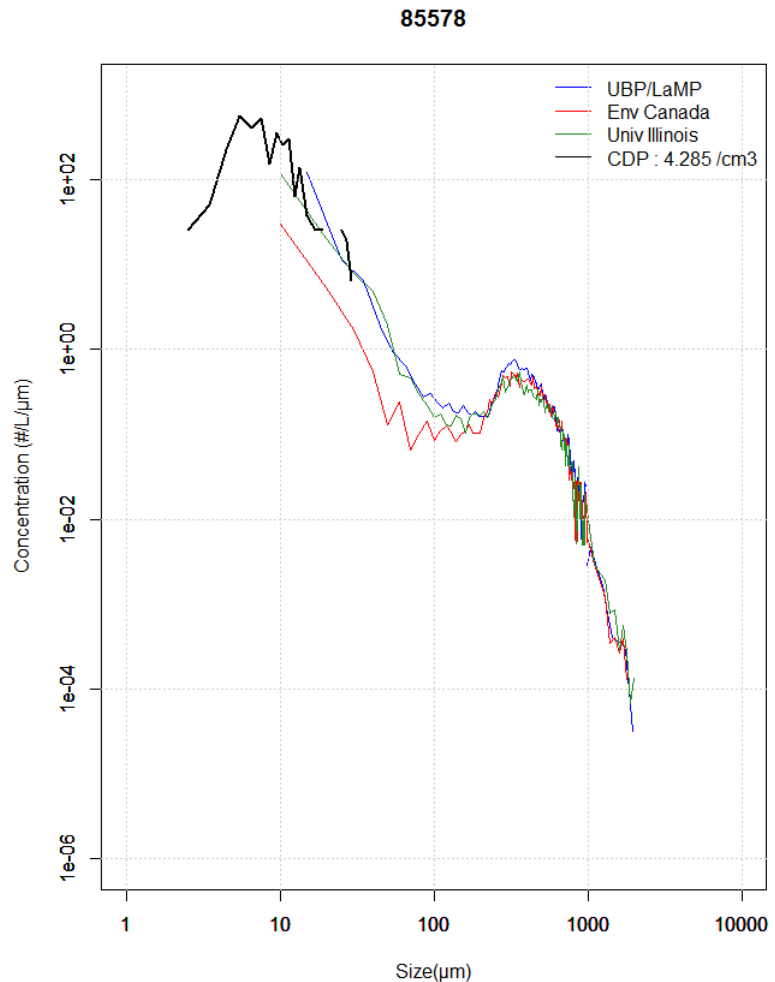
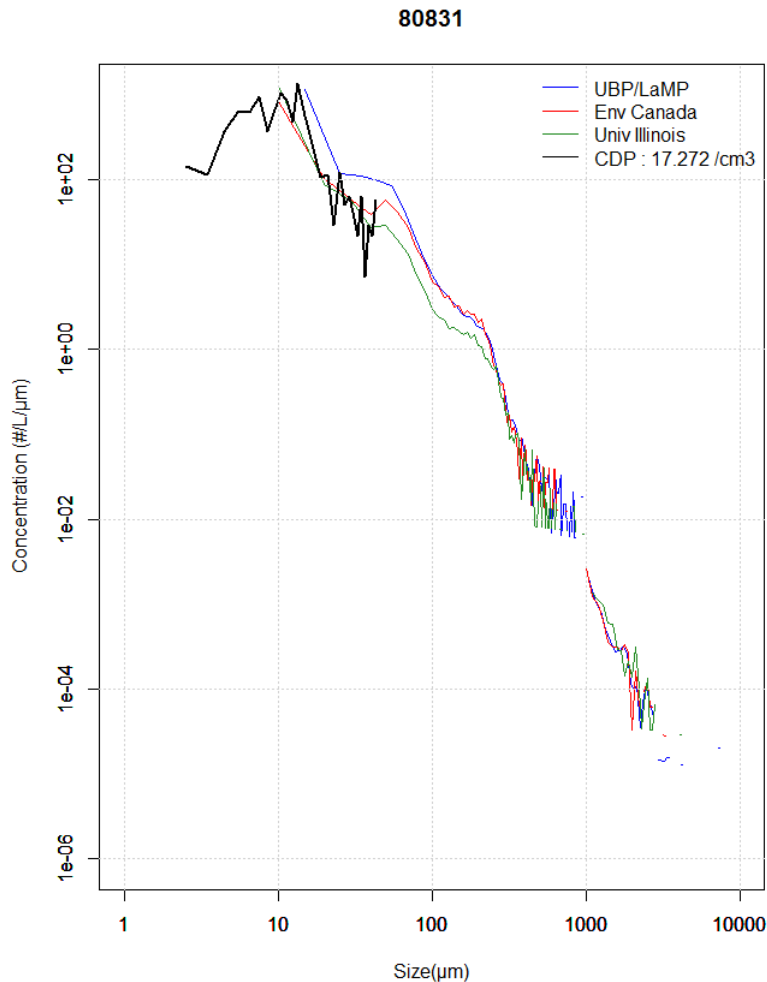
Concentration in $\#/L/\mu\text{m}$

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CDP dataset

➔ Need to finalize the PSD dataset before adding the CDP information

Preliminary results (flight 23 at 1s resolution)



High Altitude Ice Crystals (HAIC, 314314)






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Status during Darwin campaign

-  Nothing to report
-  Some pixel failure
-  Probe ok but 2 computer shut down
-  Flight with no microphysics
-  Bad calibration results on the ground

Flight	2DS	PIP	CDP
1 - test flight			
2 -			
3 -			
4 -			
5 - calibration			
6 -			
7 -			
8 -			
9 -			

Flight	2DS	PIP	CDP
10 -			
11 - transit			
12 -			
13 -			
14 -			
15 -			
16 -			
17 -			
18 -			
19 -			
20 -			
21 - calibration			
22 -			Airbus 
23 -			NASA 