

Presented by

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HAIC-HIWC Science Team Meeting 11/11/2015 - Melbourne

Cayenne PSD dataset

Cayenne data quality

Cayenne preliminary results

- Mass distribution
- Liquid water

Cayenne data quality

Cayenne preliminary results
Mass distribution
Liquid water

2D-S data

Flight	Probe status	Data acquisition	Flight	Probe status	Data acquisition
9	✓		18		
10			19		
11			20	H channel ok; V out only at very beginning	
12			21		
13			22	~20 min data missing / corrupted	
14			23		
15			24	~15 min data missing /corrupted	
16	✓		25		
17			26	H channel ok; V channel ~25 min affected	



Ground calibration ok

CDP & PIP data

Flight	PIP	CDP	Flight	PIP	CDP
9	 		18	~2 min of flight	
10			19		
11			20		
12	Missing ~10 min at the end of flight		21	<10 min at the end of flight	
13	Computer stop missing 3 min of flight		22		
14			23		
15			24		
16			25	~1 min	
17			26		



Ground calibration ok

Cayenne data quality

Cayenne preliminary results

Mass distribution

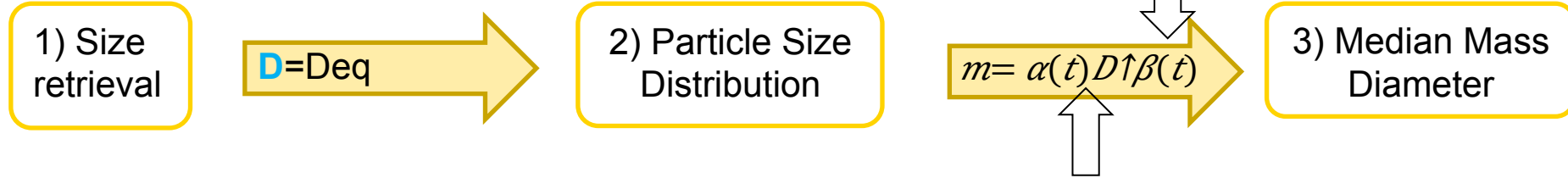
Liquid water

MMDs

Computation method:

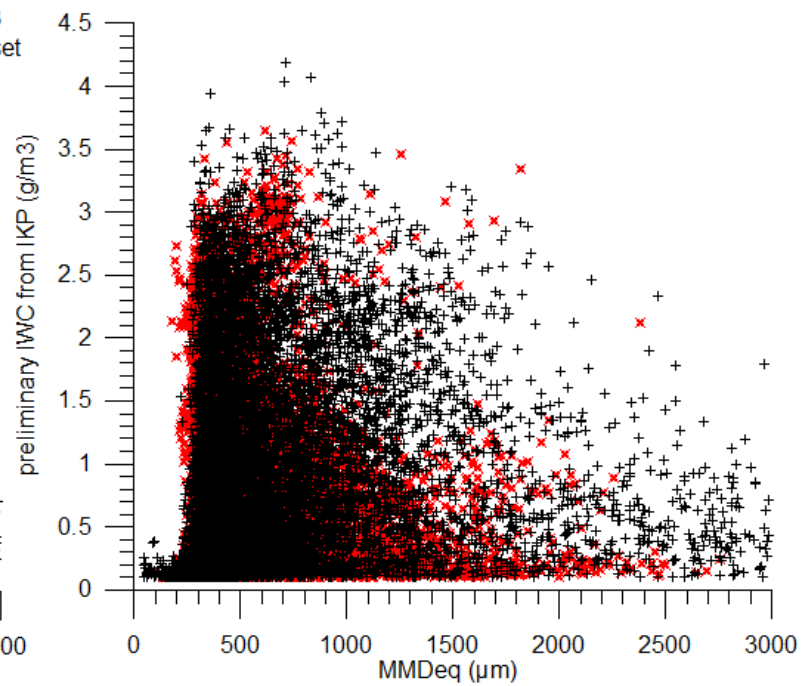
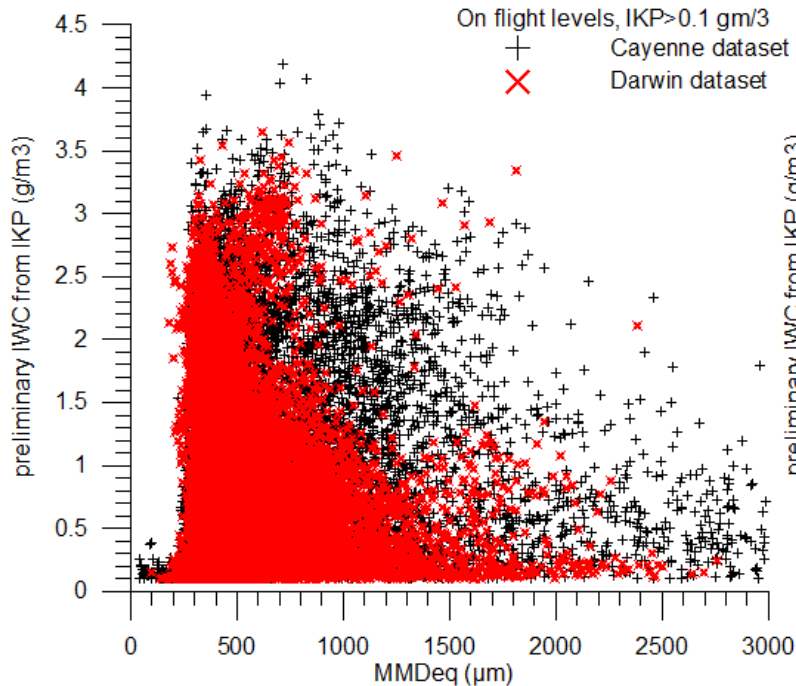
$\beta(t)$ deduced from the analysis of the images using results of 3D particle simulations

Same treatment as for Darwin



$\alpha(t)$ deduced from preliminary IKP results :

$$TWC(t) = \alpha(t) \sum_i i^3 N(i) D(i)^3 \beta(t)$$

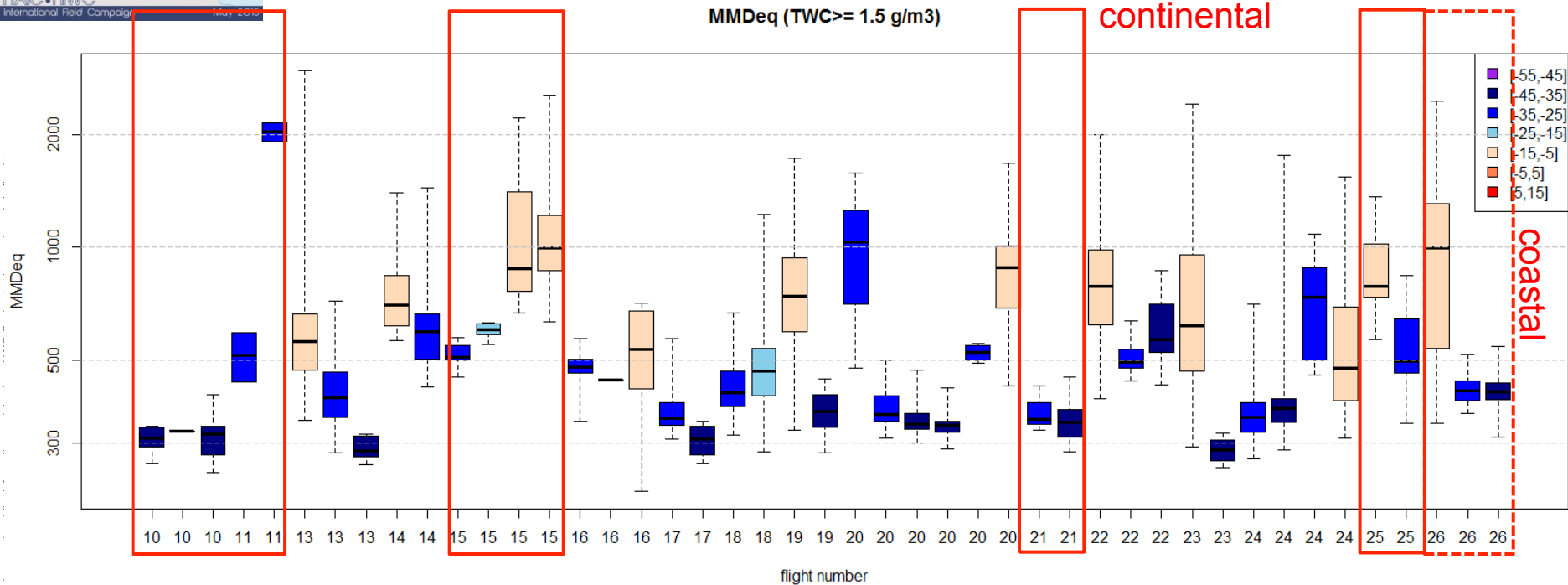
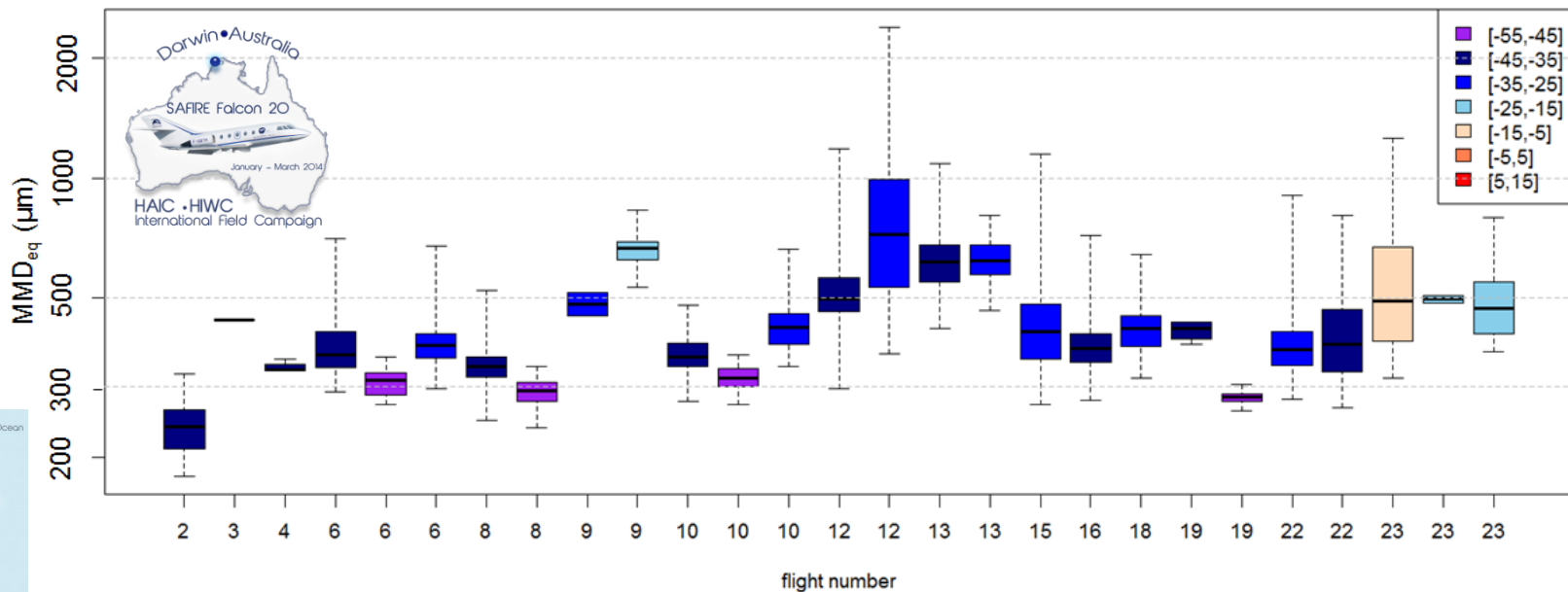


MMDs

Overview of all flights



TWC from (IKP) > 1.5 gm⁻³

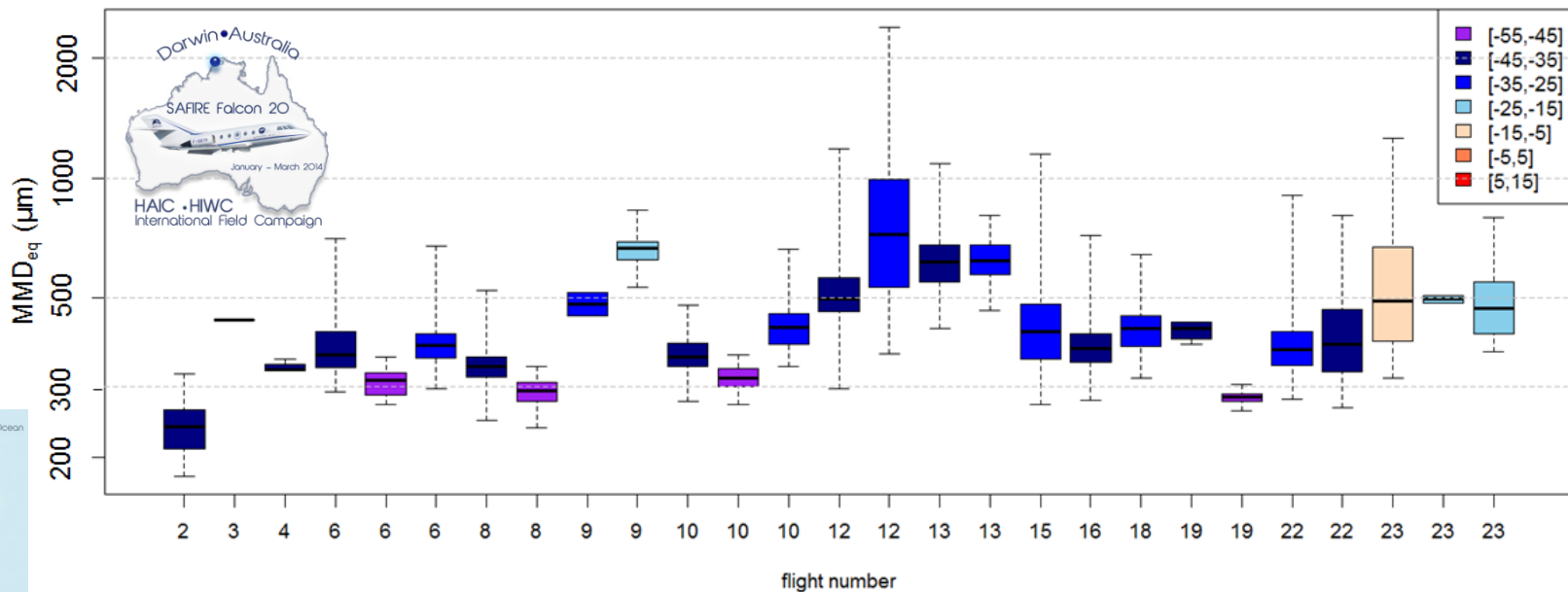


MMDs

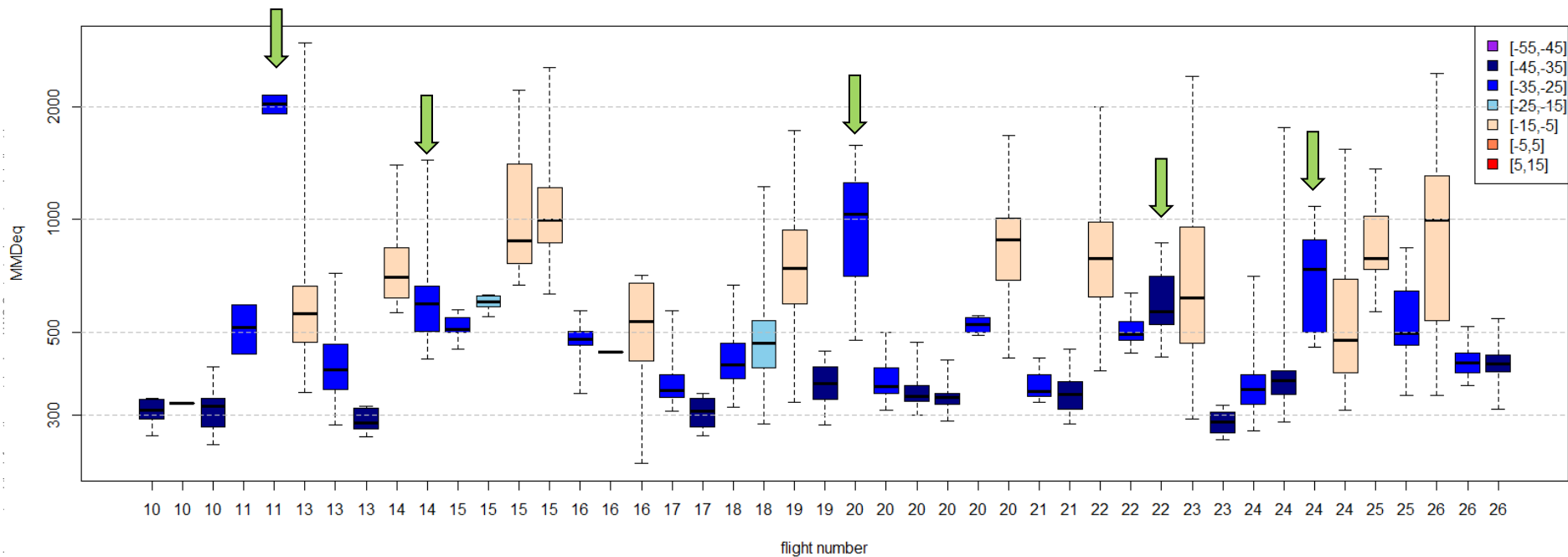
Overview of all flights



TWC from (IKP) > 1.5 gm⁻³



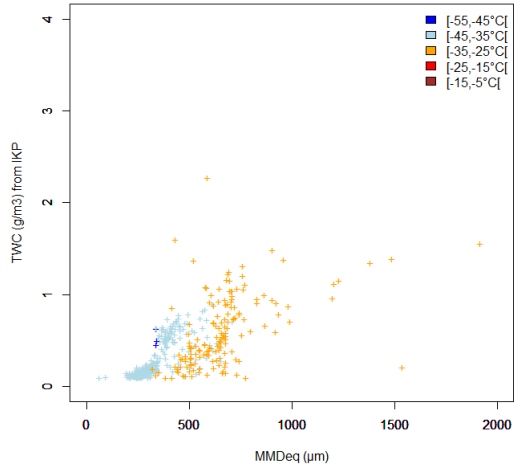
MMDeq (TWC >= 1.5 g/m³)



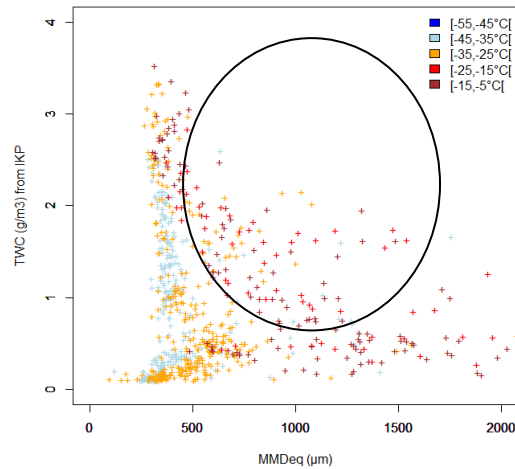
MMDs

Cayenne flights resembling flights 12 & 13 from Darwin ?

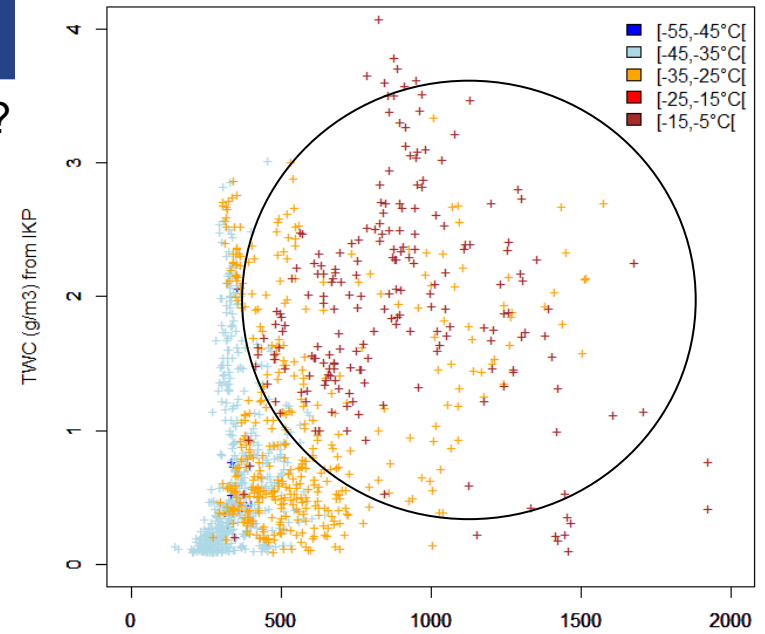
flight 11 ?



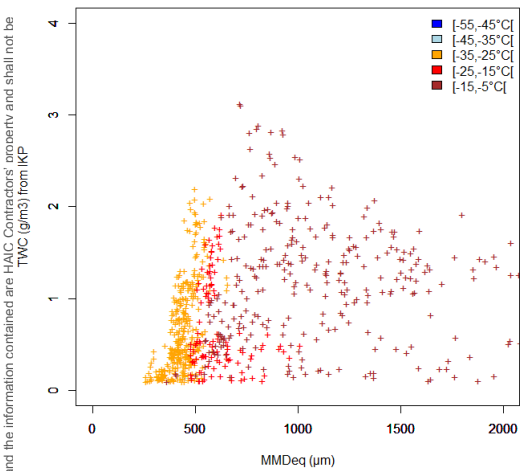
flight 24 ?



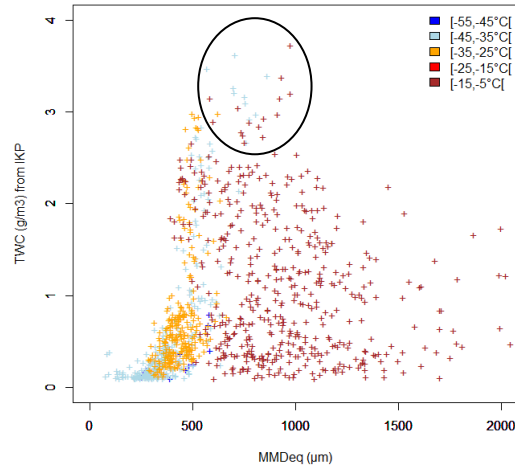
flight 20 ✓



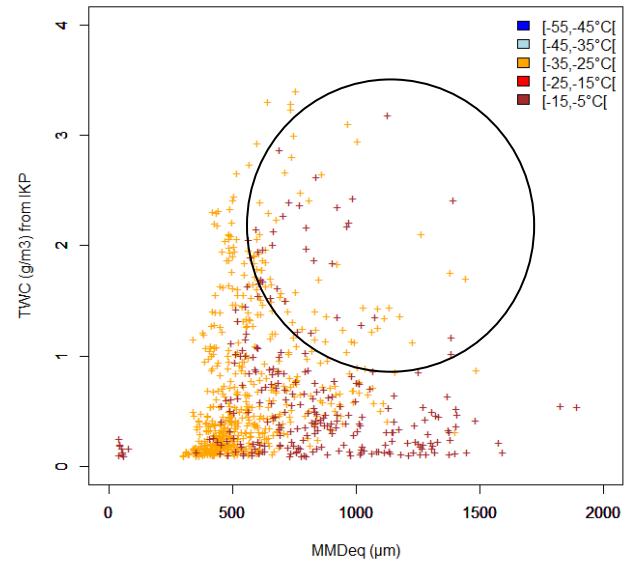
flight 15 ✗



flight 22 ✗



flight 14 ?



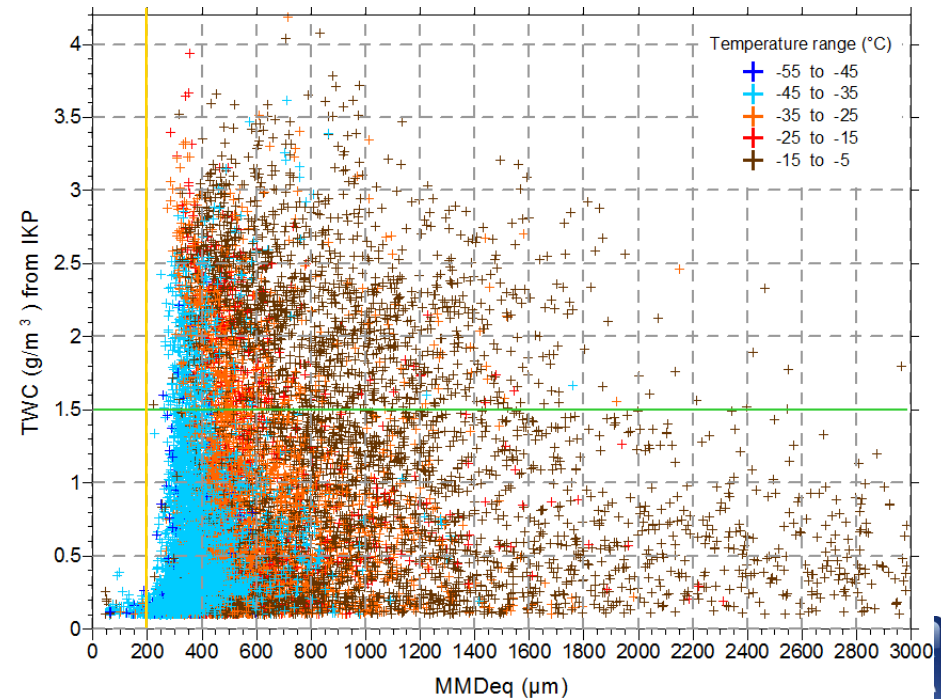
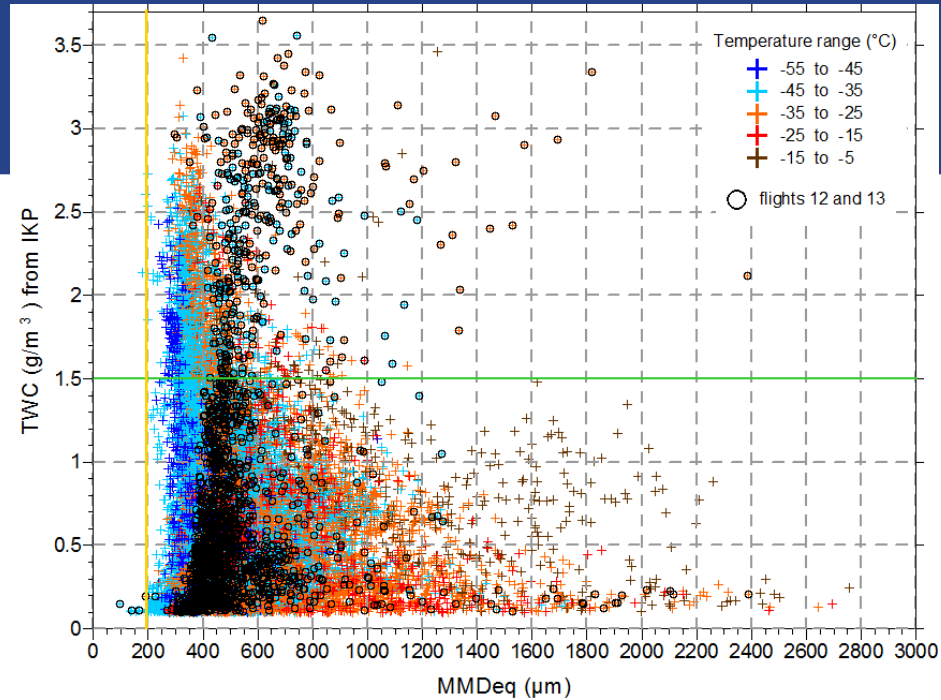
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MMDs



In cayenne dataset :

- Larger MMDs due to more sampling close to -10°C
- Trend MMD decreasing with temperature confirmed
- Still no MMDs below $200\ \mu\text{m}$

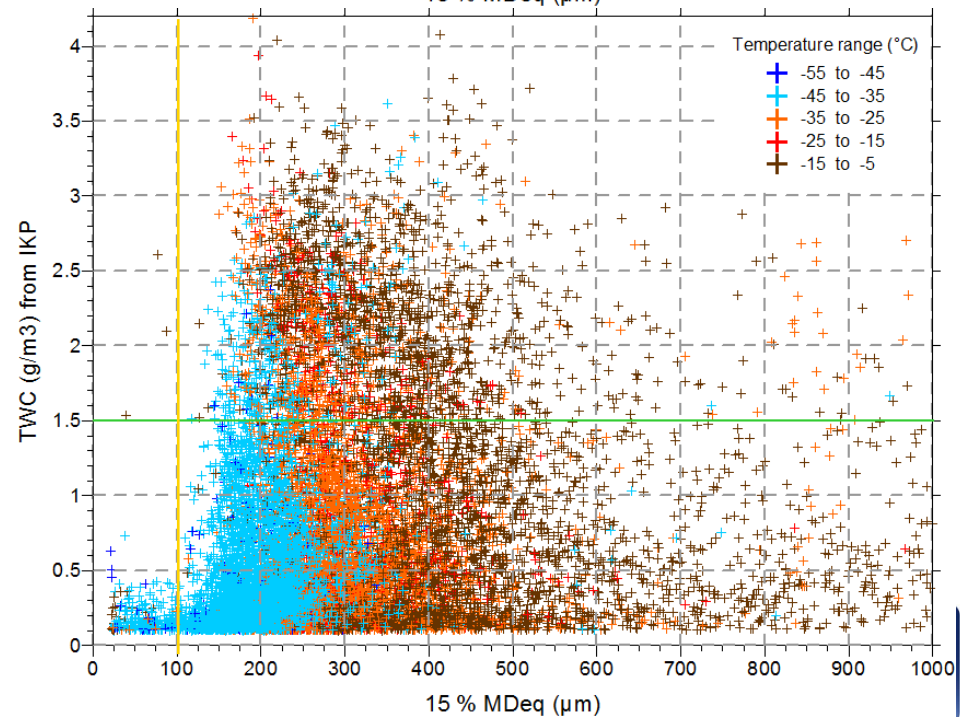
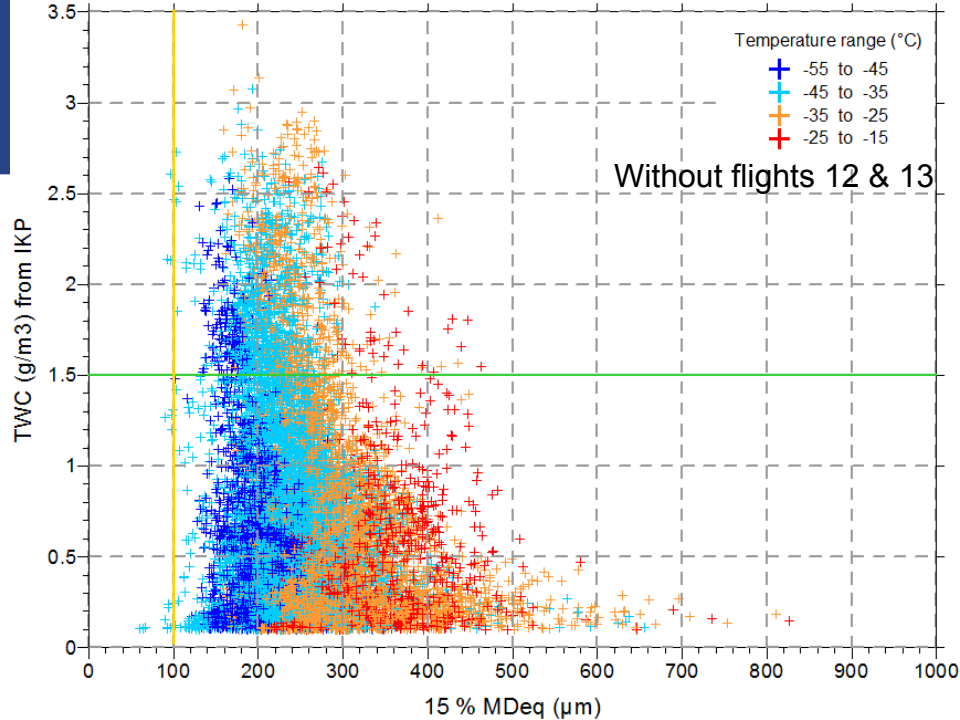


P15%

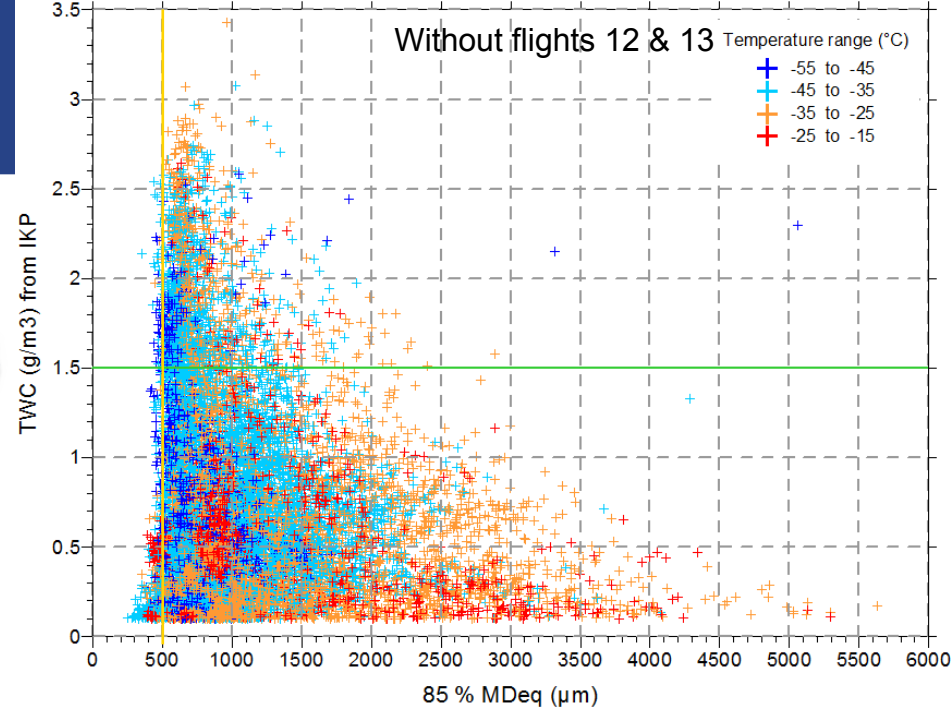


In cayenne dataset :

- Still no 15%MD lower than 100 μm at low temperatures

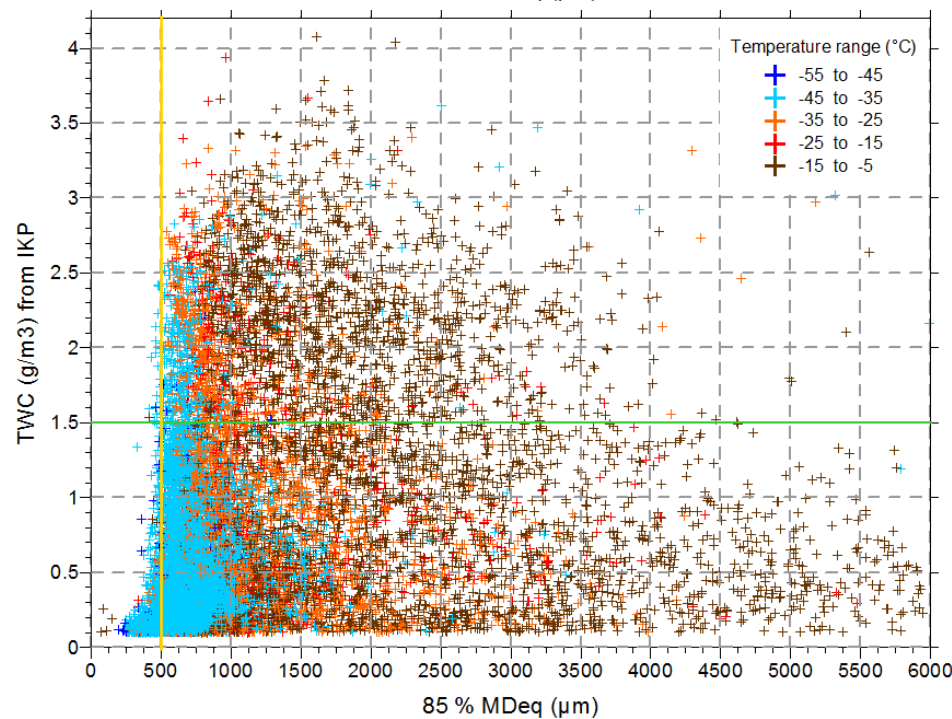


P85%



In cayenne dataset :

- Larger values of 85%Mdeq mostly due to the sampling at -10°C
- Still almost no value lower than 500 µm
- A temperature dependency seems to appear



P15 and P85% estimates



$$P15 = 0.44 * MMD, r^2 = 0.92$$

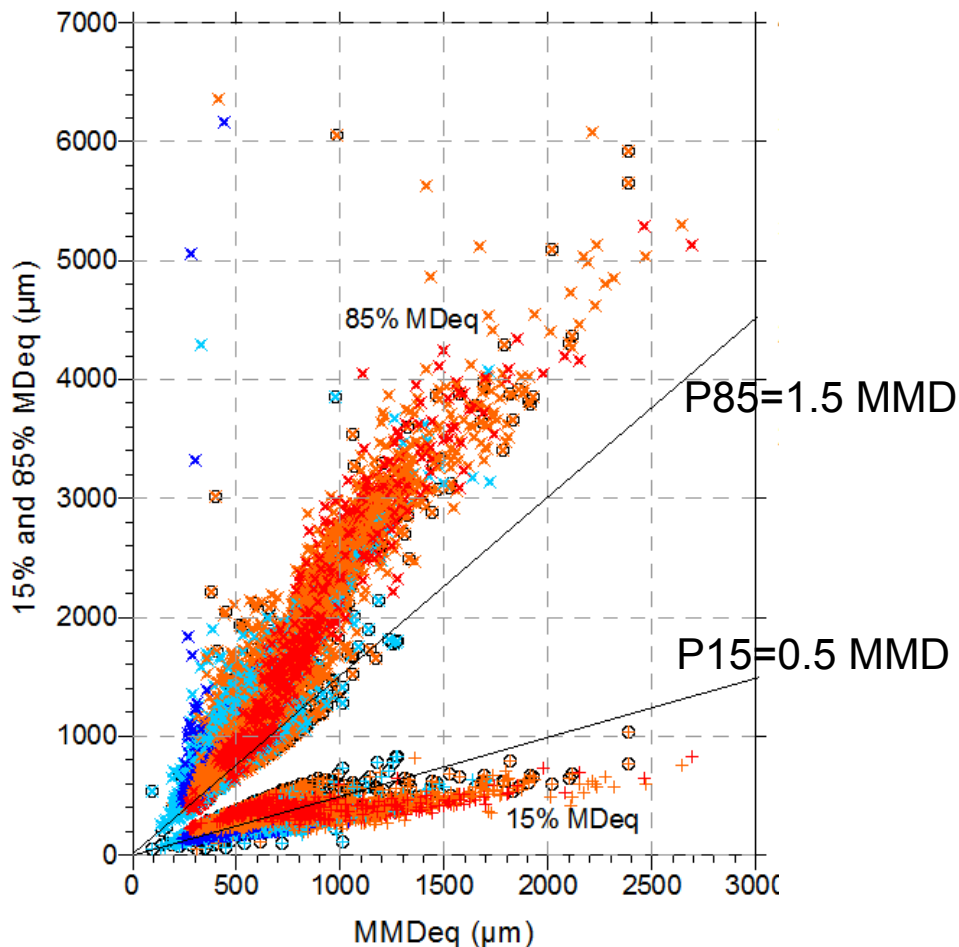
$$P85 = 2.12 * MMD, r^2 = 0.94$$



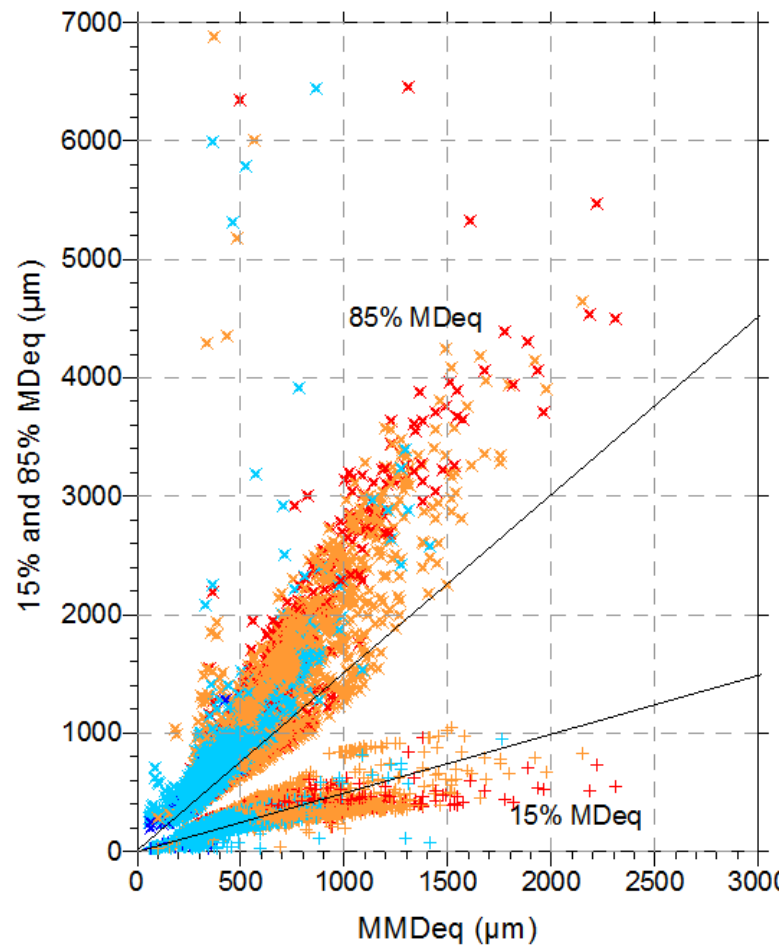
$$P15 = 0.45 * MMD, r^2 = 0.94$$

$$P85 = 2.17 * MMD, r^2 = 0.88$$

TWC from IKP > 0.1 g/m³



TWC from IKP > 0.1 g/m³



P15 and P85% estimates



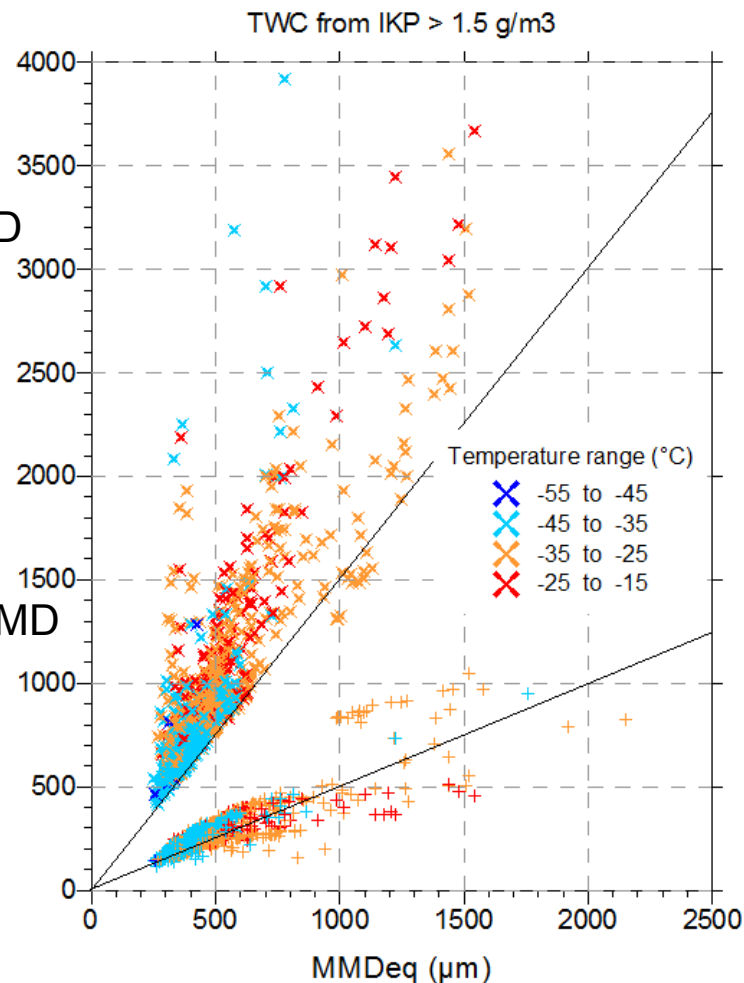
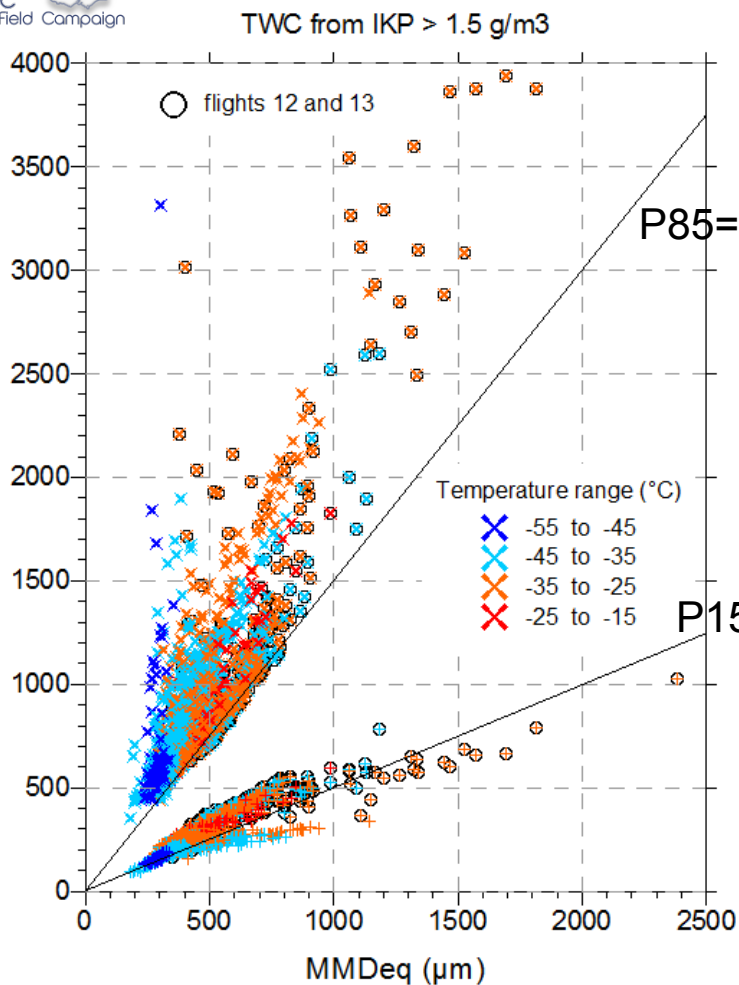
$$P15 = 0.56 * MMD, r^2 = 0.97$$

$$P85 = 2.03 * MMD, r^2 = 0.91$$



$$P15 = 0.45 * MMD, r^2 = 0.93$$

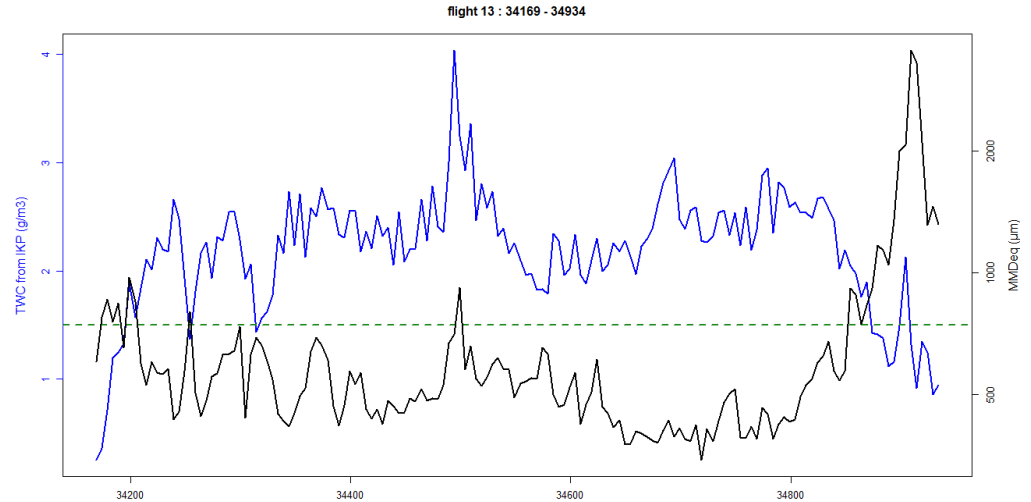
$$P85 = 1.97 * MMD, r^2 = 0.94$$



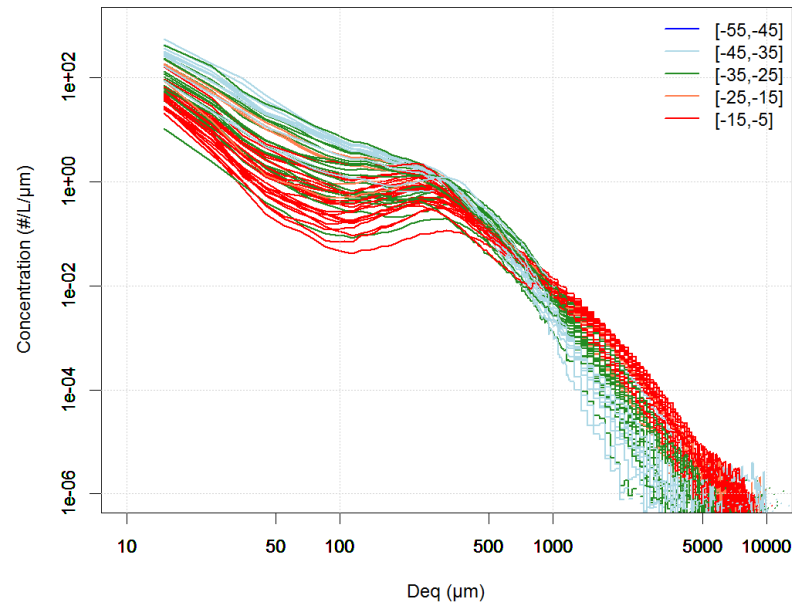
Particle Size distribution in HIWC cloud regions

Method :

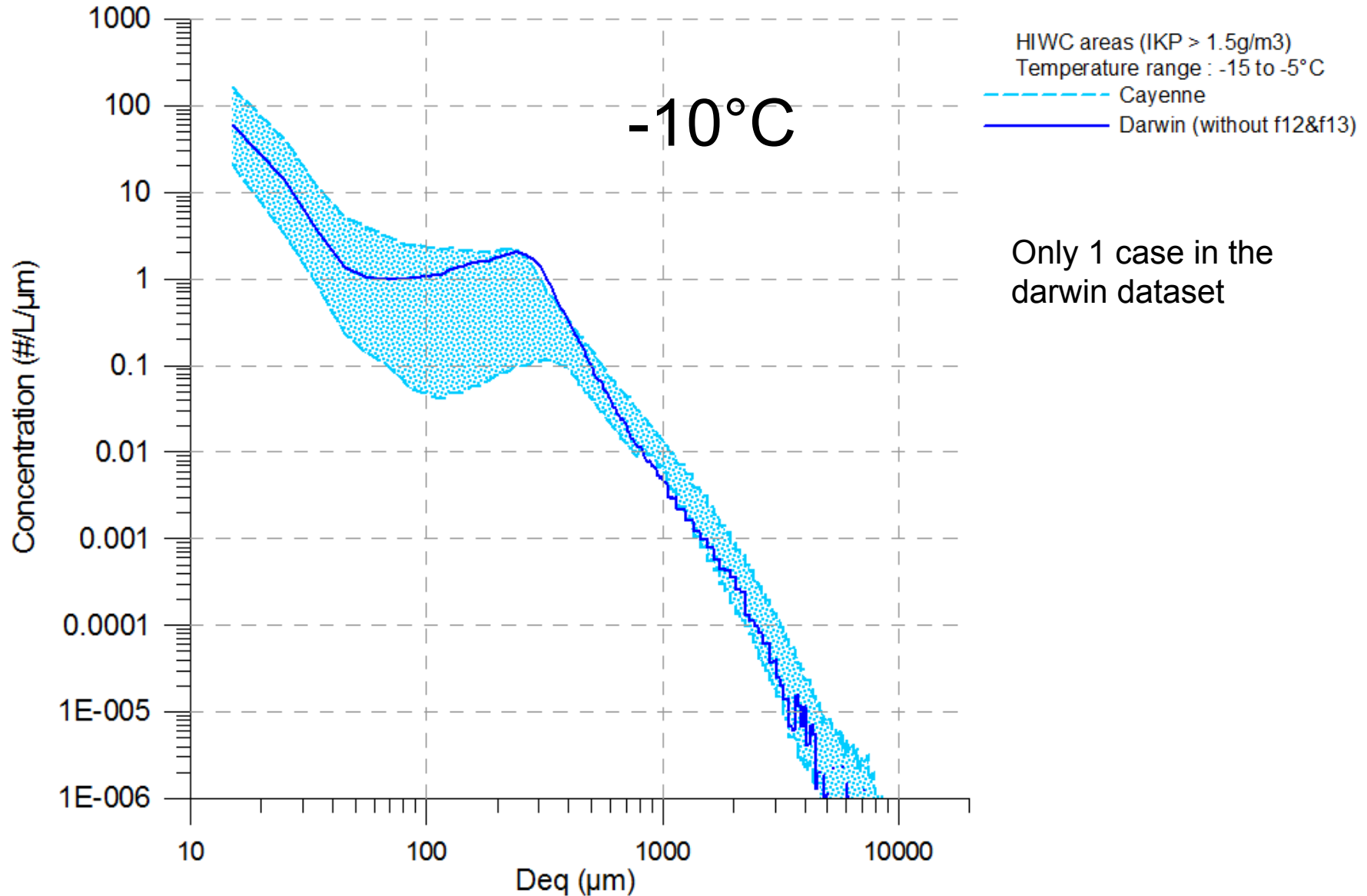
- Select flight parts with IKP TWC > 1.5g/m³ during at least 1 min
- Compute the mean composite PSD over each of these time periods
- For each temperature range, select the minimum and maximum value of the concentration for each bin (next slide)



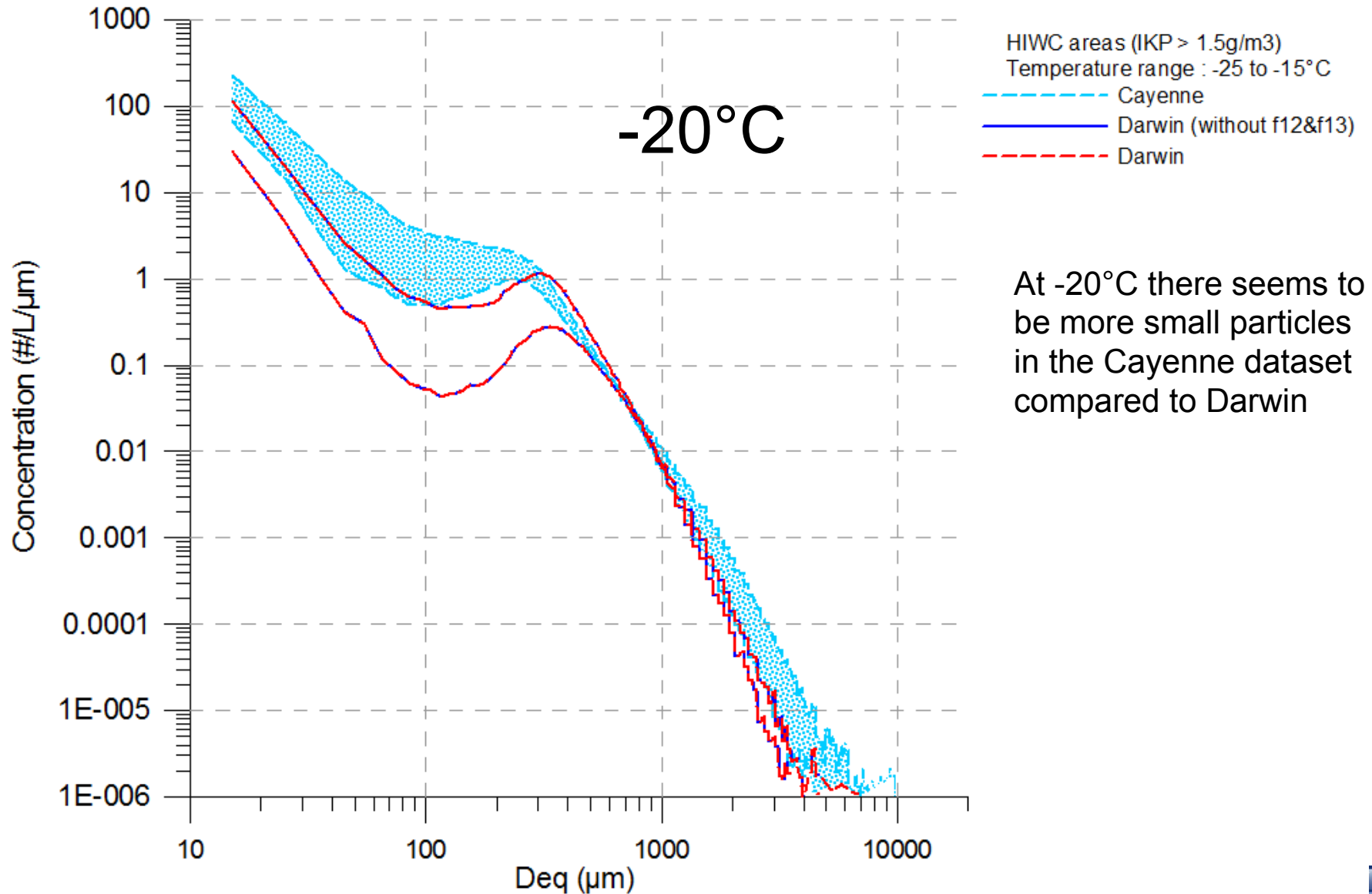
PSD in HIWC areas (>1.5g/m³)



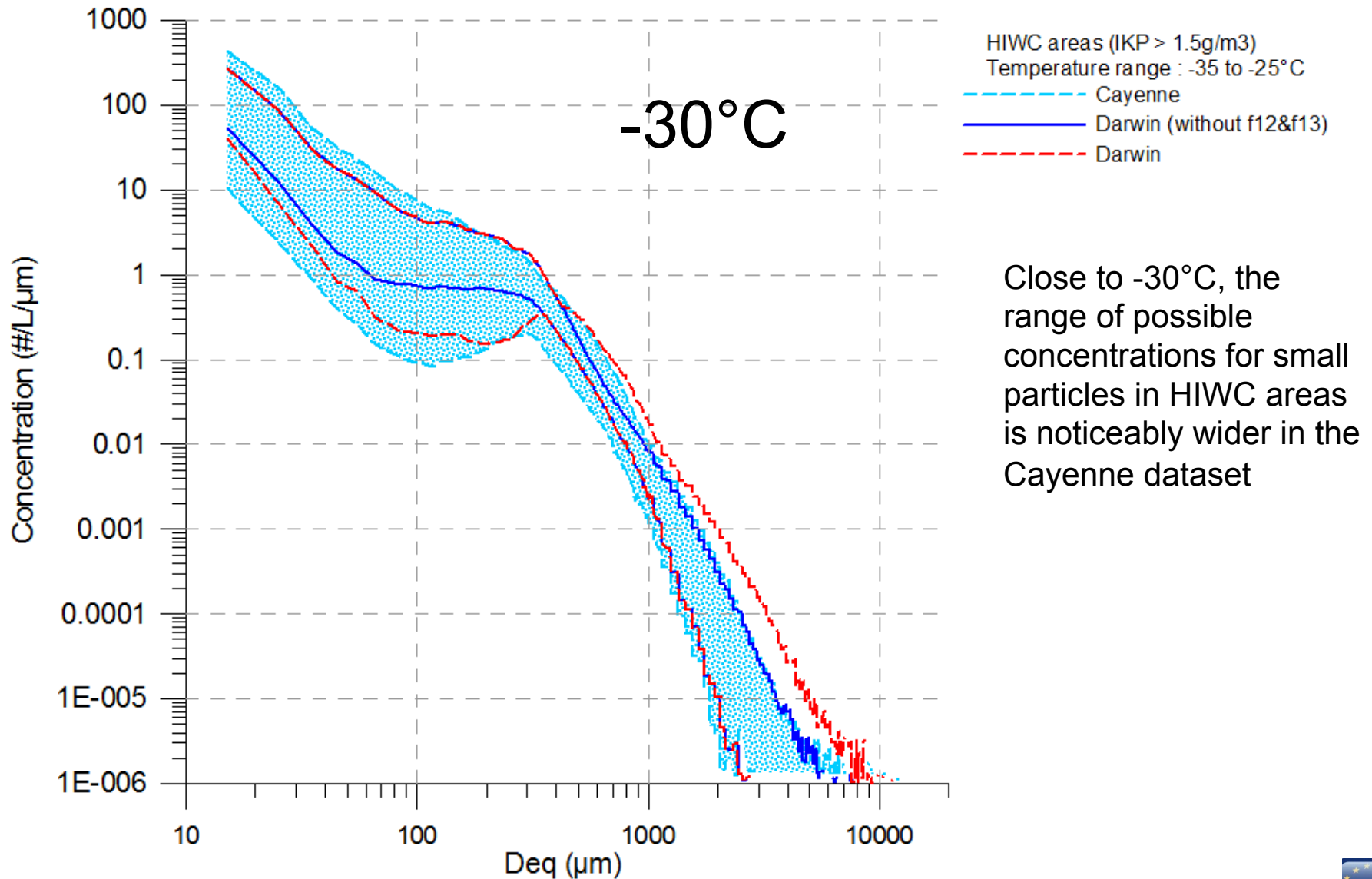
Particle Size distribution in HIWC cloud regions



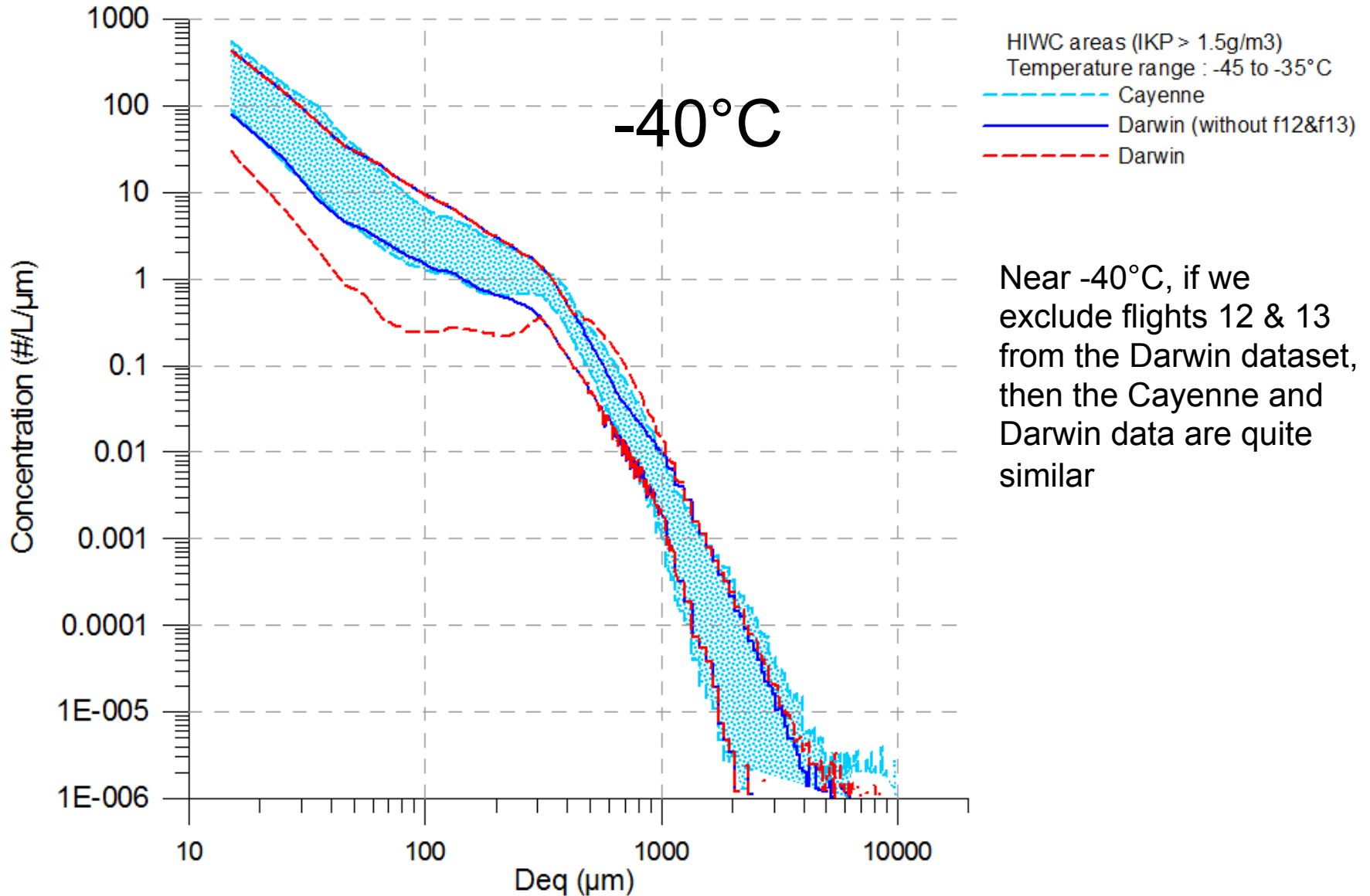
Particle Size distribution in HIWC cloud regions



Particle Size distribution in HIWC cloud regions



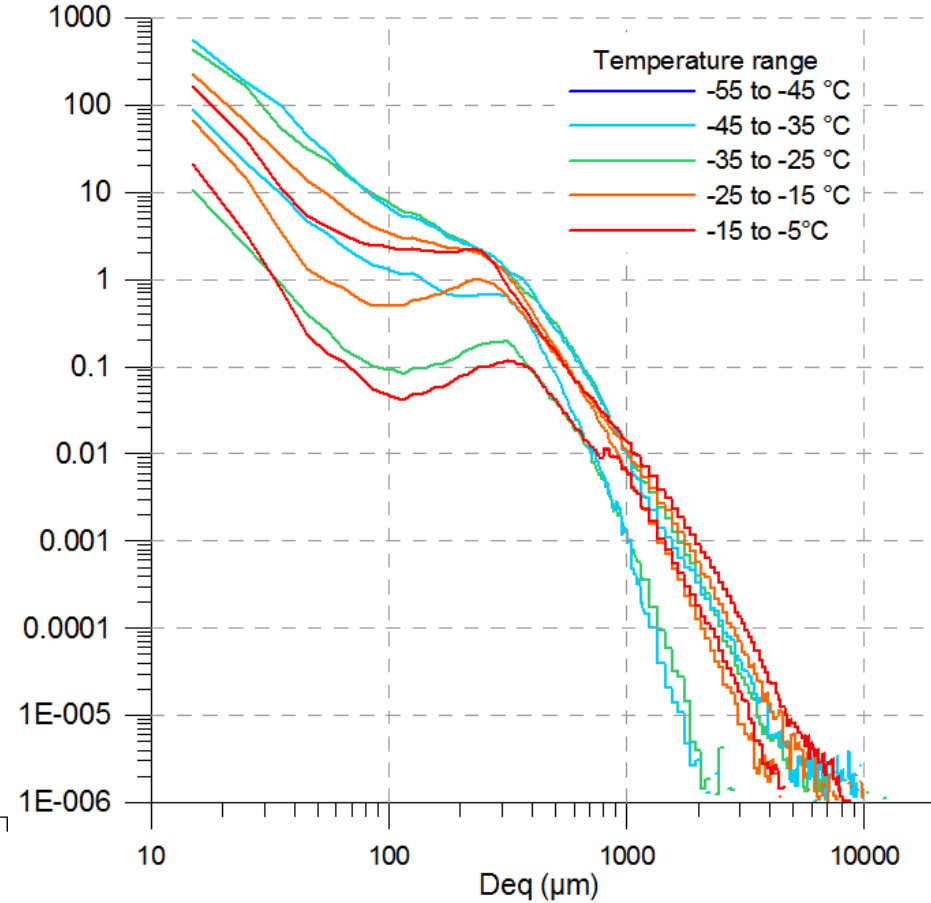
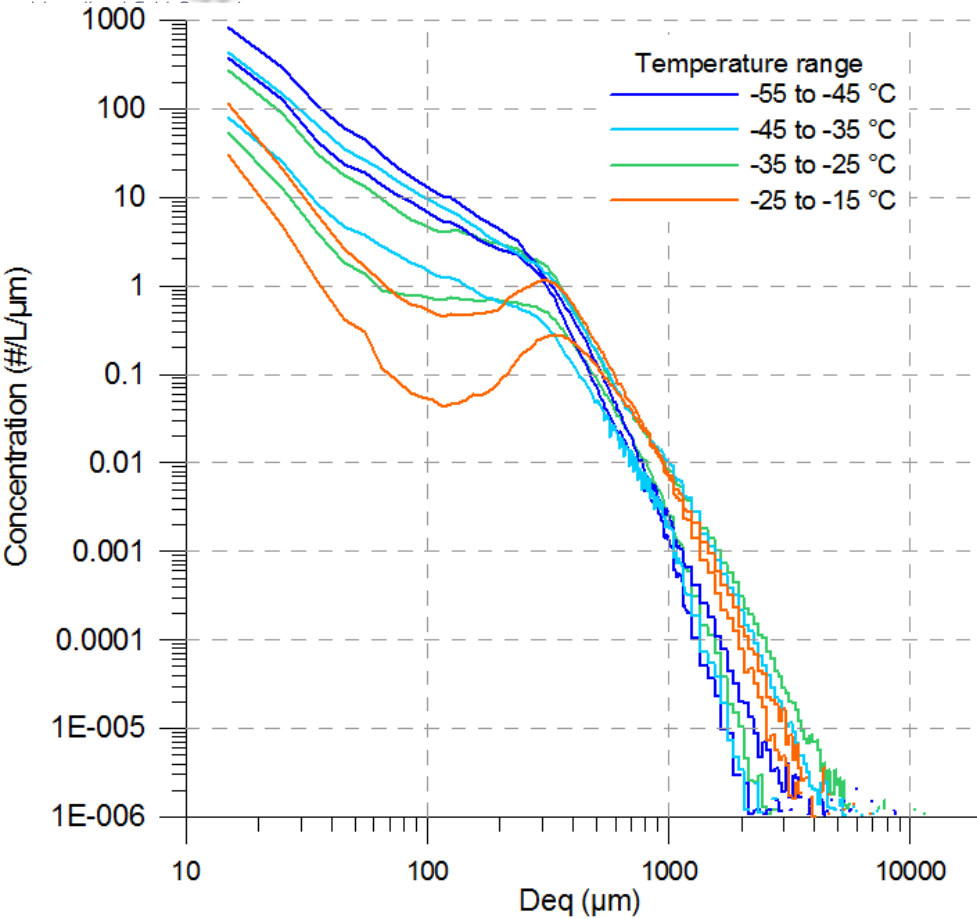
Particle Size distribution in HIWC cloud regions



Particle Size distribution in HIWC cloud regions

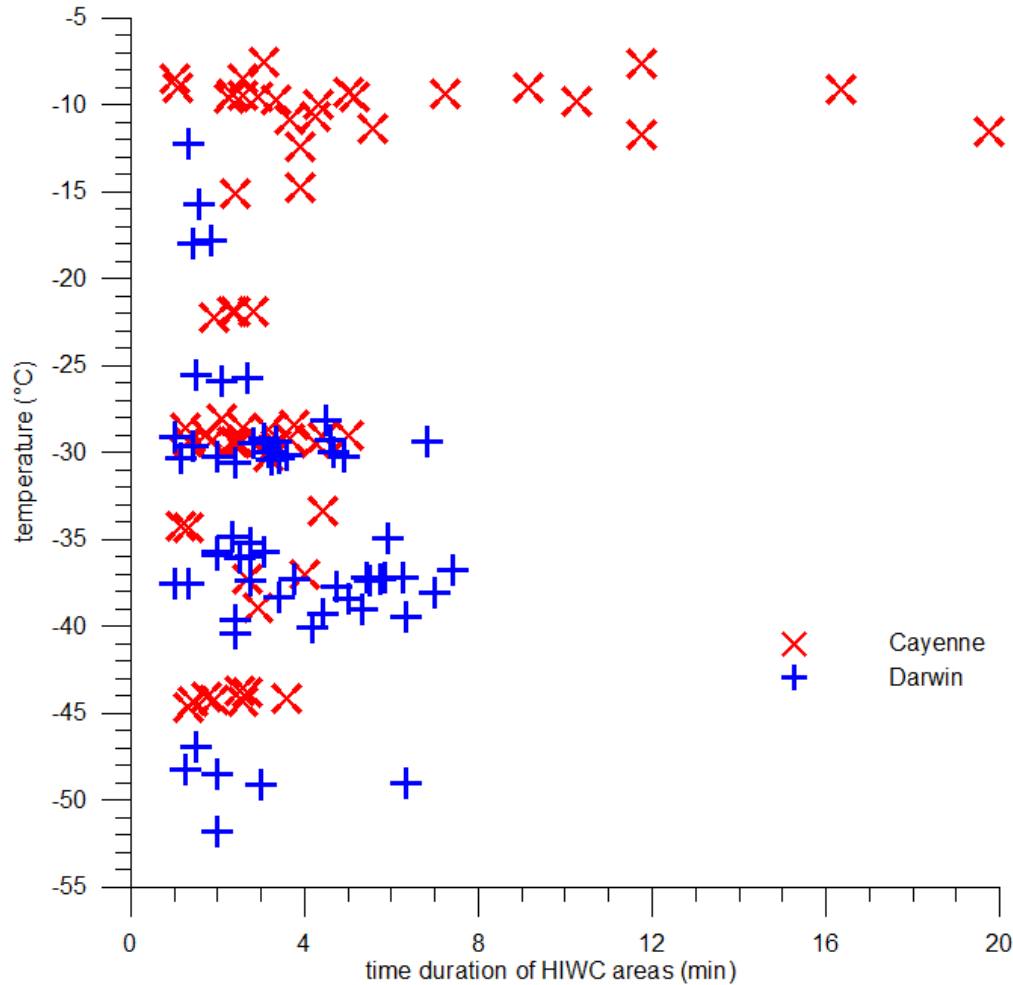


Without flights 12 and 13



Darwin – Cayenne intercomparison of high IWC

Sustained high IWC > 1.5 g/m³!



Cayenne data quality

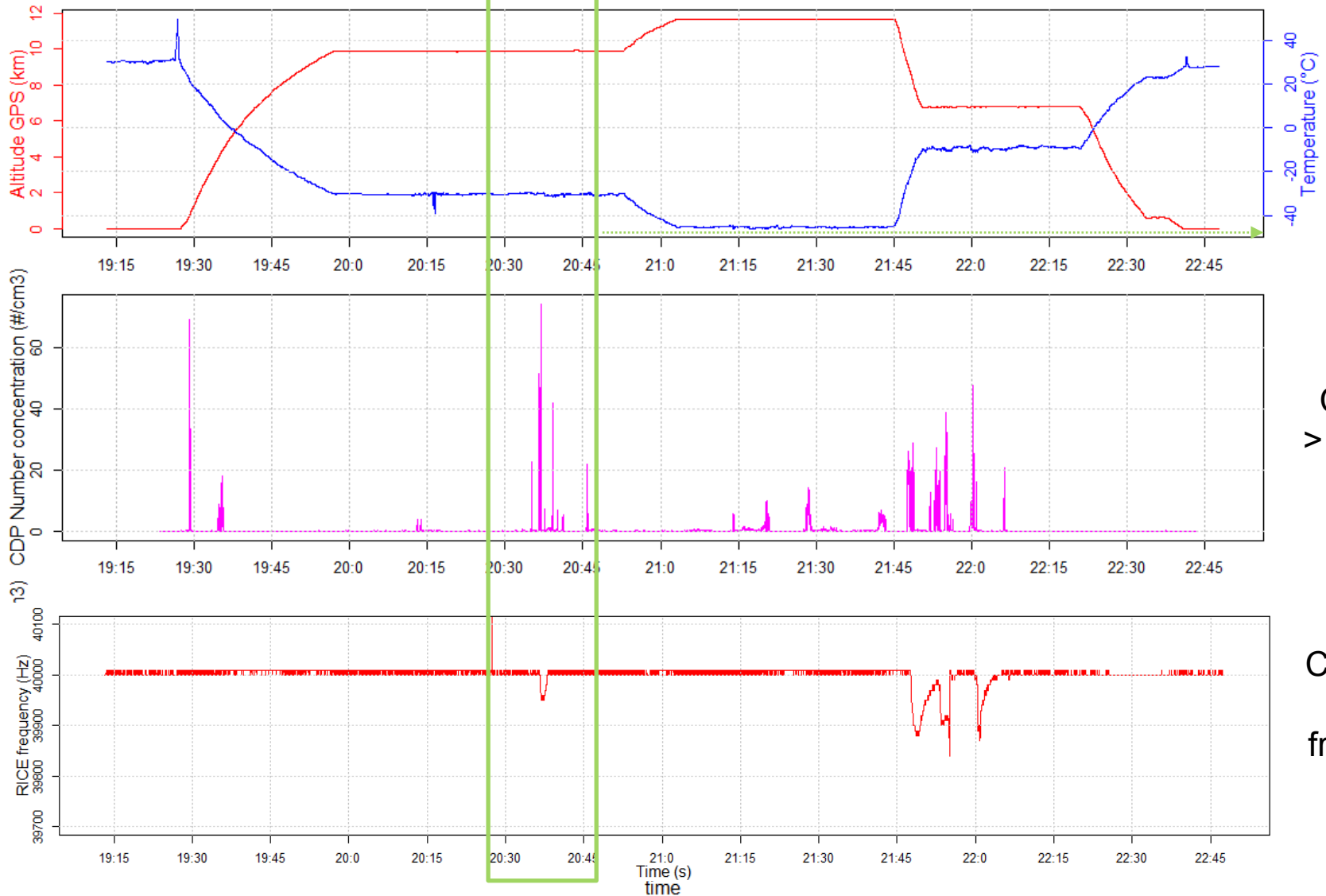
Cayenne preliminary results

Mass distribution

Liquid water

CDP & RICE

Flight 16 - 2015-05-18 - LaMP Preliminary quicklook



T ~
-30°C

CDP []
> 50 cm⁻³

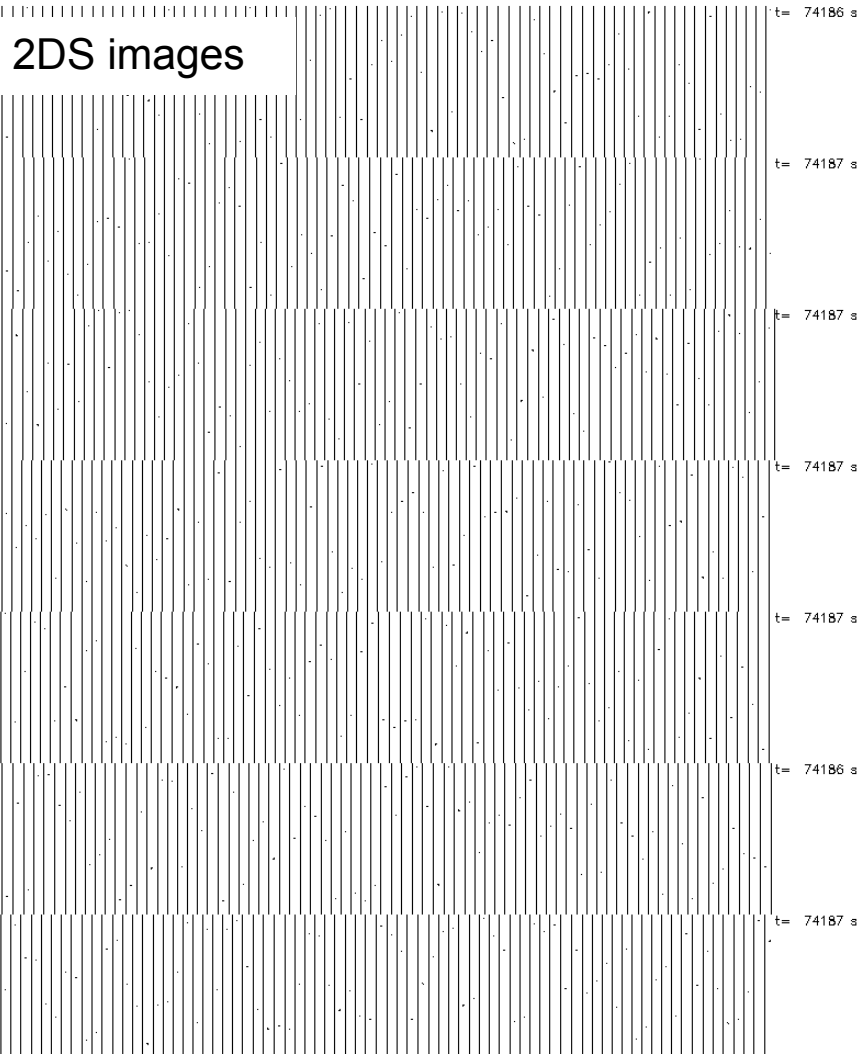
Change in
RICE
frequency

CDP & 2D-S

Flight 16

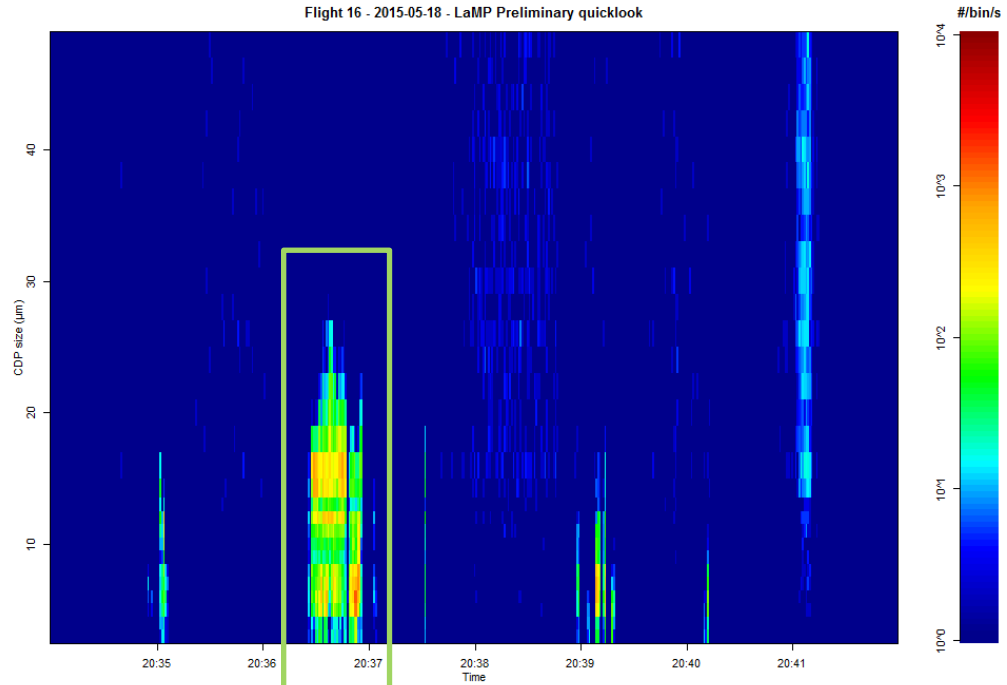
→ One case of liquid water at -30°C

2DS images

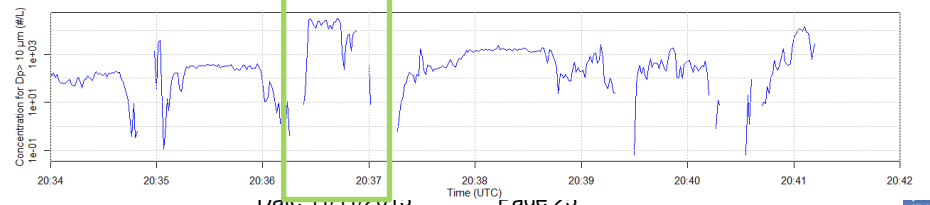
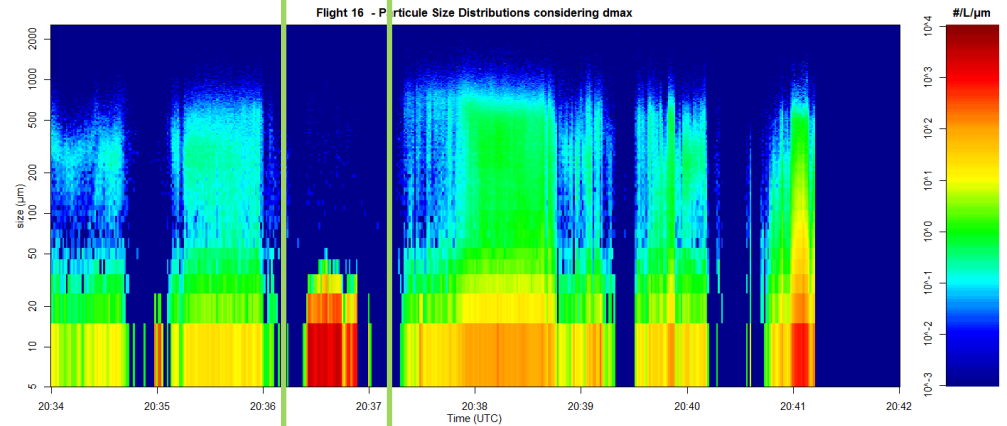


HAIC – High Altitude Ice Crystals (314314)

Flight 16 - 2015-05-18 - LaMP Preliminary quicklook



Flight 16 - Particle Size Distributions considering dmax



Conclusions

Cayenne dataset first analysis :

- Shows no MMD lower than 200 μm , like the Darwin dataset
- Confirms the MMD general decrease with temperature for cold conditions (below -20°C)
- Shows that MMDs are more widespread and reach larger values close to -10°C
- Confirms that ice crystals smaller than 150 μm account for less than 15% of the total mass
- Finds a trend in 85%MD with temperature
- Possible flights with similarities with flights 12&13 from Darwin

- Shows one case of liquid water close to -30°C
- Presents much more data of supercooled water at warmer temperatures (-20 - 10°C)

High Altitude Ice Crystals (HAIC, 314314)

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Project co-funded by the European Commission within the
Seventh Framework Programme (2012-2016)



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