SORPIC 2010

PRELIMINARY RESULTS

Jean – François Gayet, *Christophe Gourbeyre and Régis Dupuy*

LaMP CNRS / Université Blaise Pascal

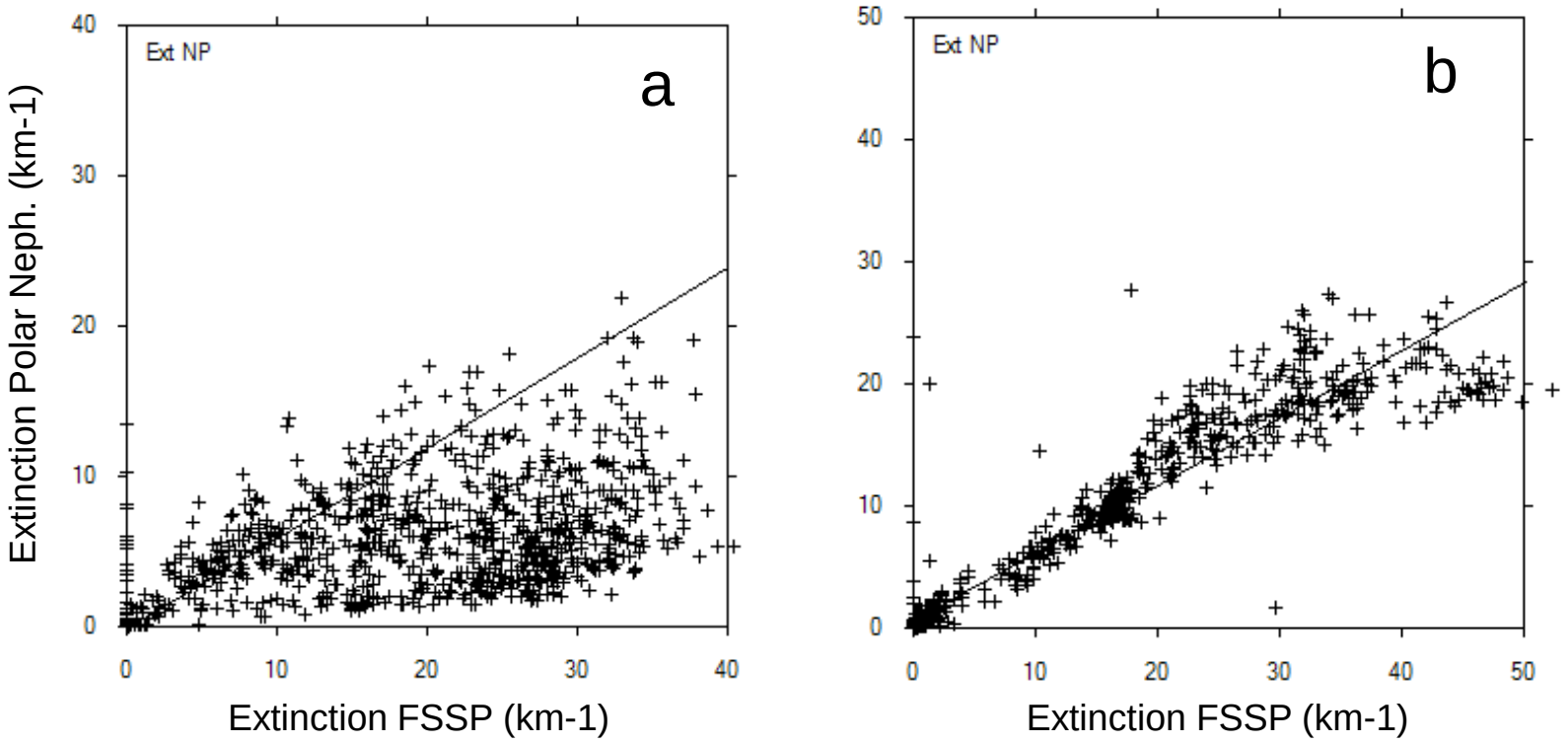
CPI

FSSP & PN

CPI installation

FSSP and Polar
Nephelometer installation

FSSP and Polar Nephelometer comparisons



PN extinction versus FSSP extinction (10 and 5 May flights respectively).

(i) A bad working of the PN de-icing. The de-icing power was positively tested at ground leading to conclude that the probe was properly de-iced as for previous campaigns (ASTAR2007, POLARCAT) during flights with similar (or worst) cloud icing conditions.

(ii) ***The icing of the exhaust tube of the PN*** (observed some times after landing) which may partially block the airflow inside the sampling tube. This assumption was not longer relevant because even without significant icing of the exhaust tube, similar trouble-shootings were evidenced.

(iii) ***The probe location on the pylon***. This issue should be regarded under three points:

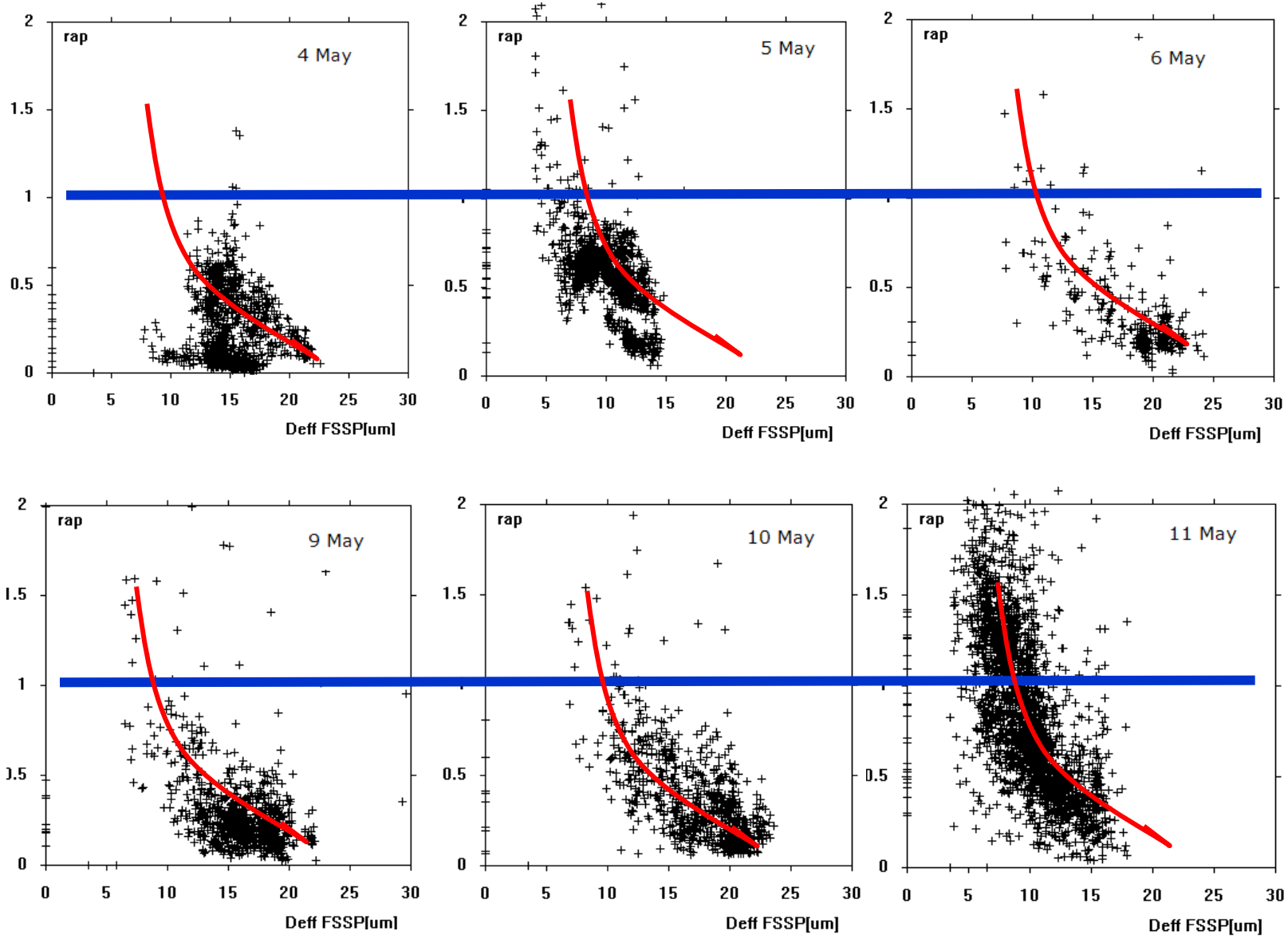
The FSSP and PN probes are mounted very closely together;

● The FSSP and PN sampling tubes are not enough upstream situated regarding the leading edge of the aircraft wing ;

● The FSSP and PN sampling tubes are not located enough far away from the wing skin.


SAND

Icing of the instruments after the flight on 11 May

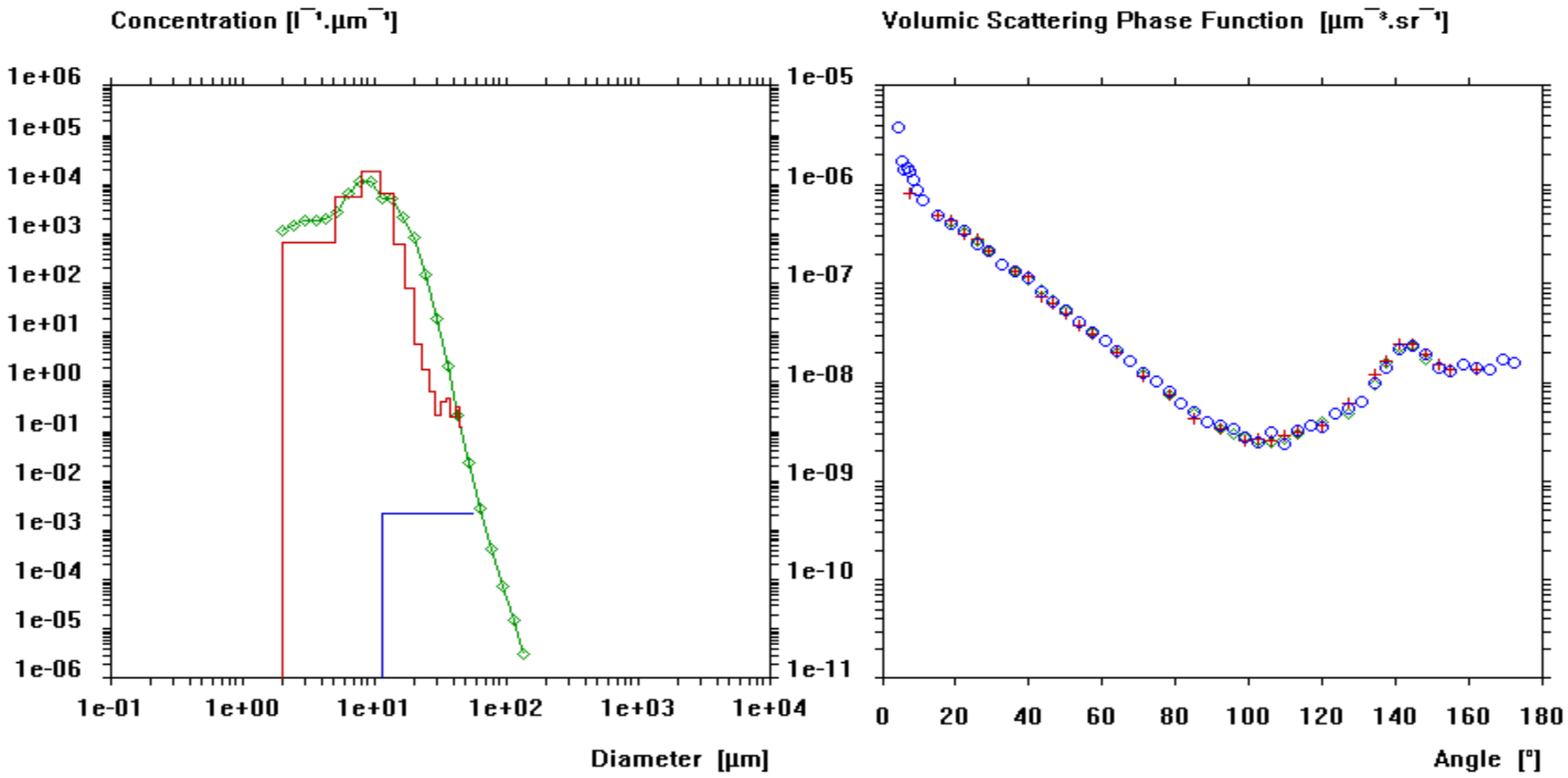


Comparison of the PN/FSSP extinction ratio versus the effective diameter

CONCLUSIONS

Due to a relative small inlet diameter of the PN (16 mm versus 40 mm for the FSSP), the large droplets are cut of the PN measurements due to the imperfect flow. These effects seem not to be significant on FSSP and CPI measurements.

No correlation have been found between the extinction ratio and both the cloud droplet concentration and FSSP extinction suggesting these parameters not to be determinant to explain the reported trouble shootings.



Inverse size dist.

FSSP size dist.

Inverse phase func.

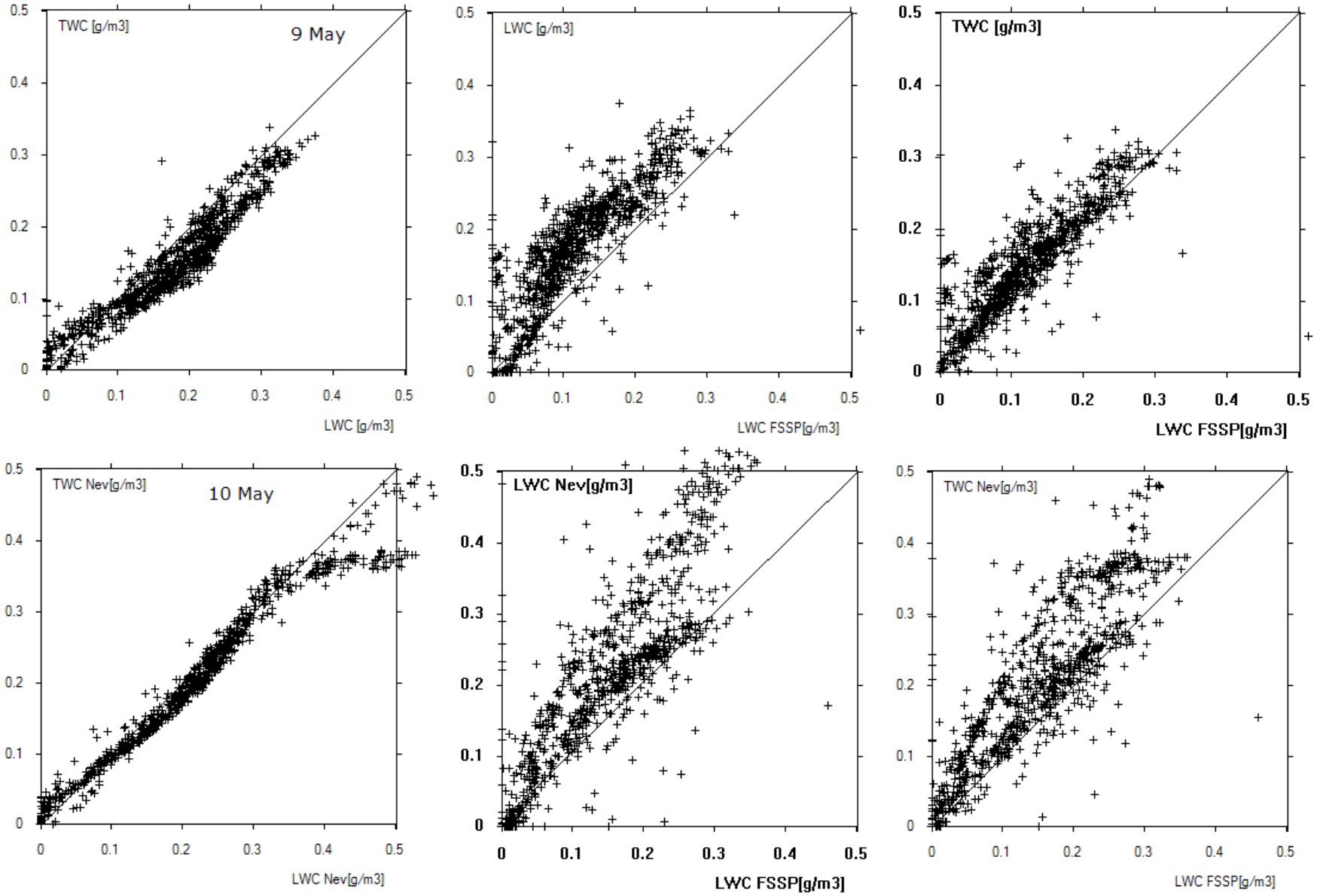
Measured phase func.

Fonc theorique (FSSP)

ConcFssp = 91.7 cm-3	ConcInv = 85.9 cm-3	err = -6.3 %
LWCFssp = 0.050 g/m3	LWCInv = 0.075 gm-3	err = 49.5 %
DmFssp = 9.2 µm	DmInv = 10.2 µm	err = 10.6 %
DeffFssp = 10.2 µm	DeffInv = 13.7 µm	err = 34.2 %
ExtFssp = 14.0 km-1	ExtInv = 16.4 km-1	err = 14.3 %

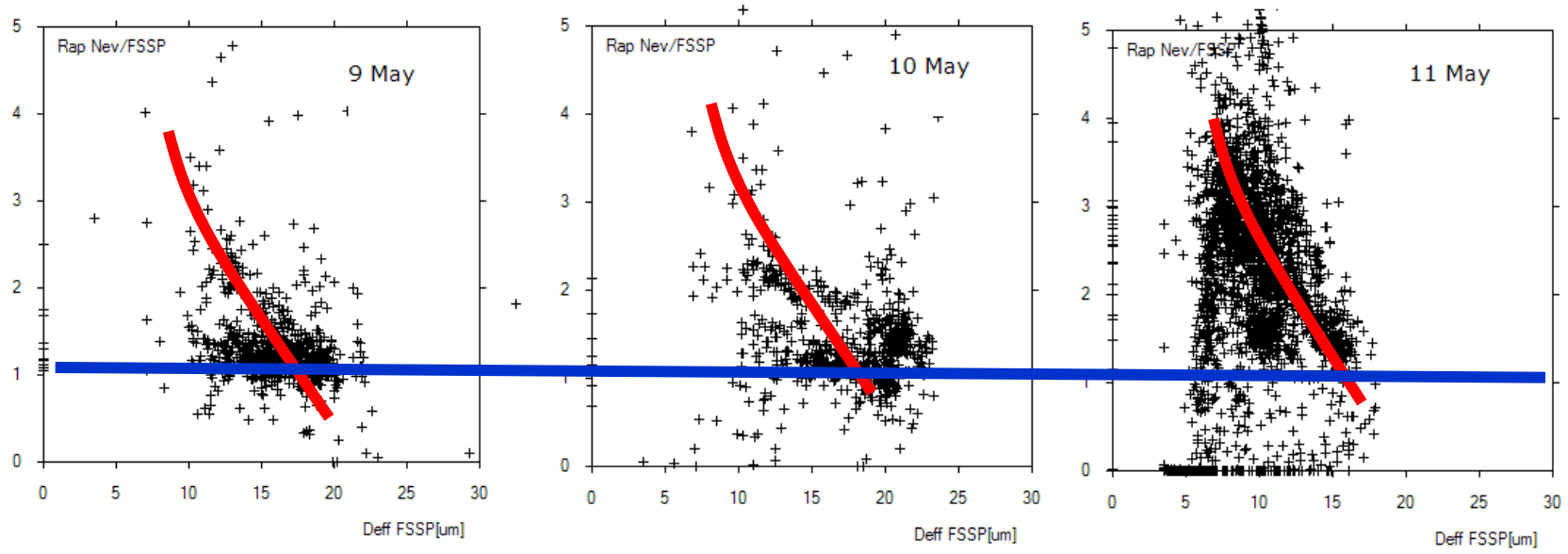
Results from flight on 11 May

FSSP and Nevzorov comparisons



TWC / LWC Nevzorov comparisons, LWC Nev/ FSSP and TWC Nev/FSSP.

Upper panels : Flight on 9 May, Bottom panels : Flight on 10 May.



Comparison of the TWCNev / FSSP Liquid water content ratio versus the effective diameter.

CONCLUSIONS

- Better reliability of the TWC channel ??

Relationship between FSSP and Nevzorov seems to be related to the droplet diameter.

Effects of compressed streamlines near the aircraft skin (nose location) which are more sensitive for smaller droplets (inertial effect).

Overconcentration of small droplets (see Drumond's work (1980 ??).

Nevzorov location on P5 not suitable ??

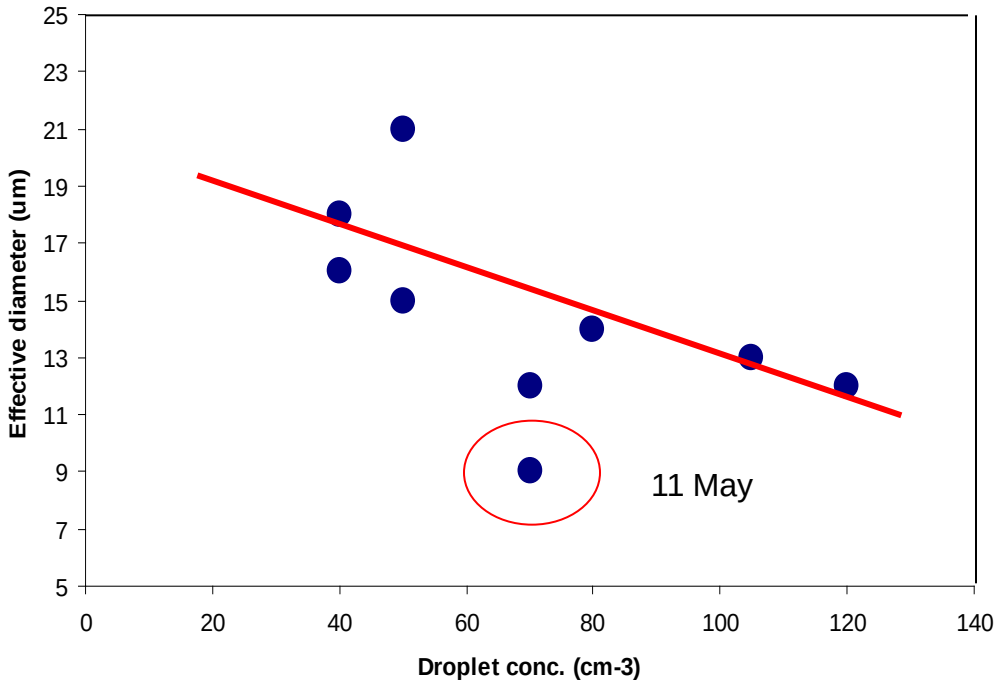
To be confirmed with adiabatic LWC profile (air temperature no available ?)

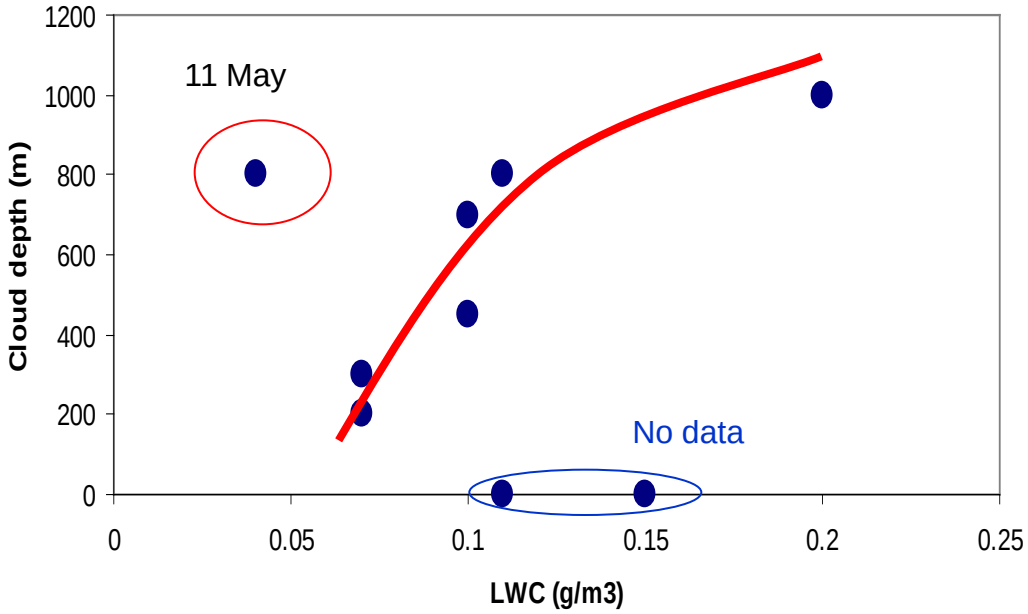
SUMMARY of RESULTS

Cloud probes working

Date	FSSP	NP	CPI	Nevrorov
4 May	OK	OK	OK	NO
5 May	OK	OK	OK	NO
6 May	OK	OK	OK	NO
9 May	OK	OK	OK	OK
10 May	OK	OK	OK	OK
11 May	OK	OK	OK	OK
15 May	OK	OK	NO	OK
16 May	OK	OK	NO	OK
17 May	OK	OK	NO	OK

Date	Times (UT)	Cloud type	Conc. (cm-3)	LWC (g/m3)	Deff (μm)	Conc100 (l-1)	Cloud depth (m)
4 May	08 :15 14 :00	Sc layer	105	0.15	13	0.2	-
5 May	07 :35 11 :00	Sc layer	120	0.10	12	0.1	500 300
6 May	06 :45 07 :20	Sc layer	50	0.20	21	1.4	1000
9 May	10 :30 15 :00	Sc layer	40	0.10	16	0.3	700
10 May	07 :15 10 :30	Sc layer	50	0.11	15	0.1	800
11 May	6 :45 11 :45	Sc layer	70	0.04	9	0.	800
15 May	13 :00 16 :30	Sc layer	80	0.11	14	-	Cloud top
16 May	10 :00 14 :30	Sc layer	70	0.07	12	-	300
17 May	08 :15 12 :00	St	40	0.07	18	-	150 300


Effective diameter (um)
25
23
21
19
17
15
13
11
9
7
5
0
20
40
60
80
100
120
140
Droplet conc. (cm-3)
11 May


Cloud depth (m)
1200
1000
800
600
400
200
0
0
0.05
0.1
0.15
0.2
0.25
LWC (g/m3)
11 May
No data

CONCLUSIONS

Only Water (supercooled) stratiform clouds have been sampled.

Clean air observed during all the campaign long (see concomitant optical and radiatives observations).

Why droplet concentration – Effective diameter relationships are modulated (40 cm^{-3} – 120 cm^{-3} range) ??

No clear indication from back-trajectories (air comes mostly from far Northern regions).

No significant ice particles have been measured even in the deeper experienced cloud (1000 m, 6 May).

Air temperature is needed.