

Cox Wind Tunnel

NASA High Speed
Video

FSSP inlet

D ~ 5cm

TAS ~ 70m/s



Courtesy
Ed Emery and Dean Miller
NASA Glenn Research
Center

NRC Convair 580



**Extinction probe
0.2-200 km^{-1}**



FSSP 5-95 μ m



FSSP
5-95 μ m

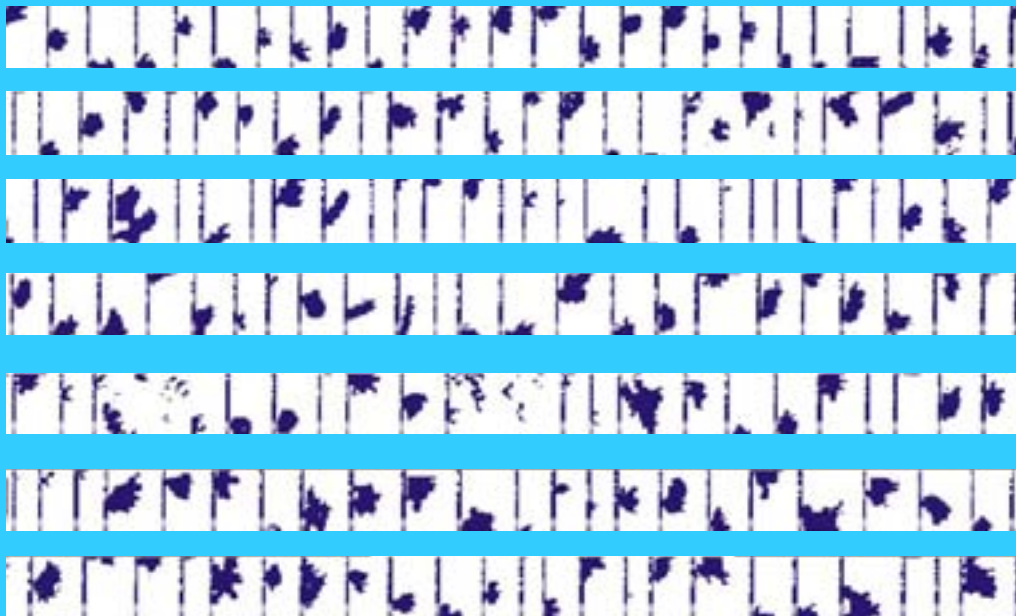
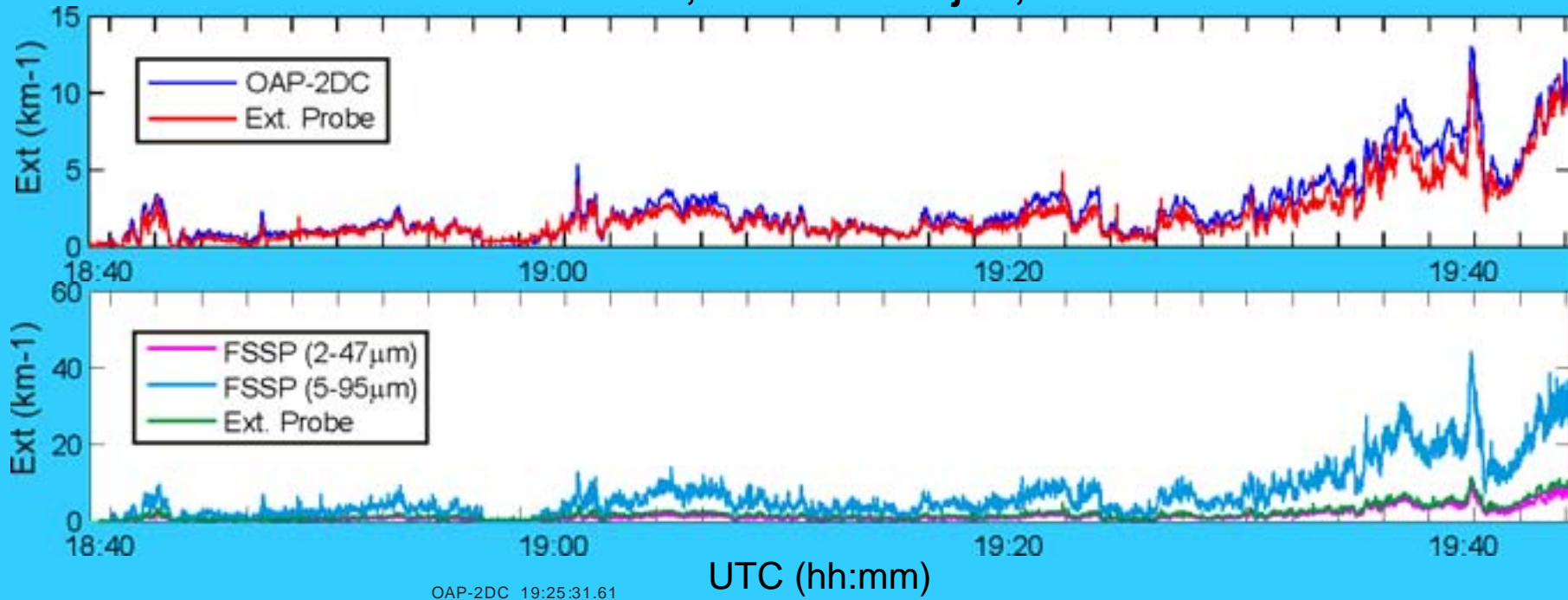


FSSP 2-47 μ m



FSSP
2-47 μ m

01 March 2007, CloudSat Project, S. Ontario

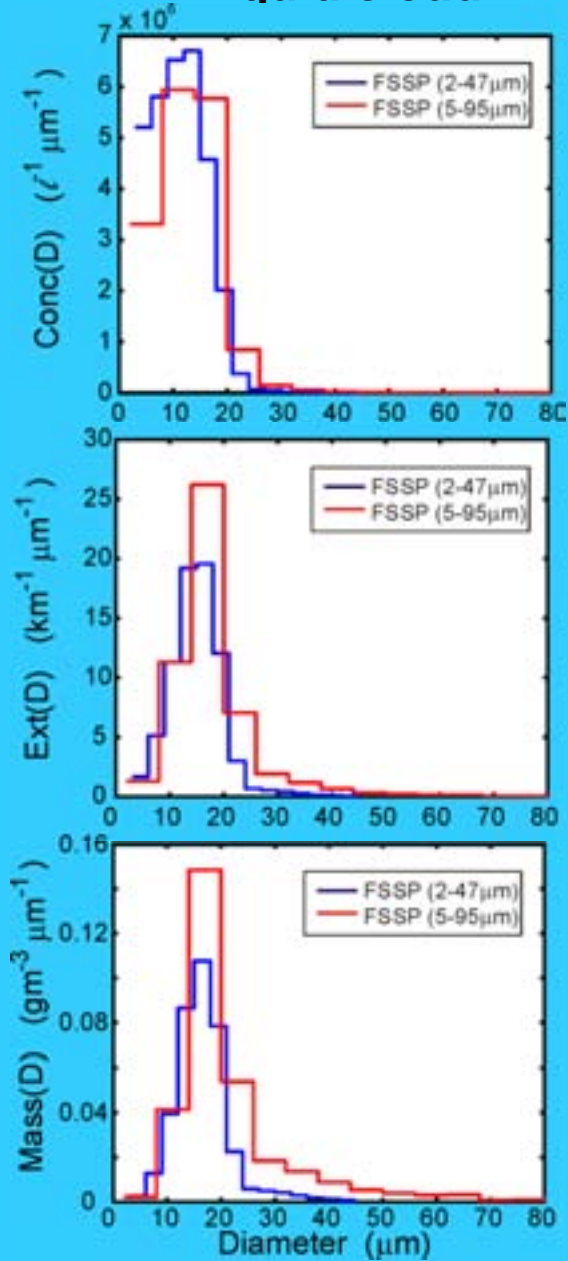


$$\beta_{FSSP} = \frac{Q\pi}{4} \sum n_i D_i^2$$

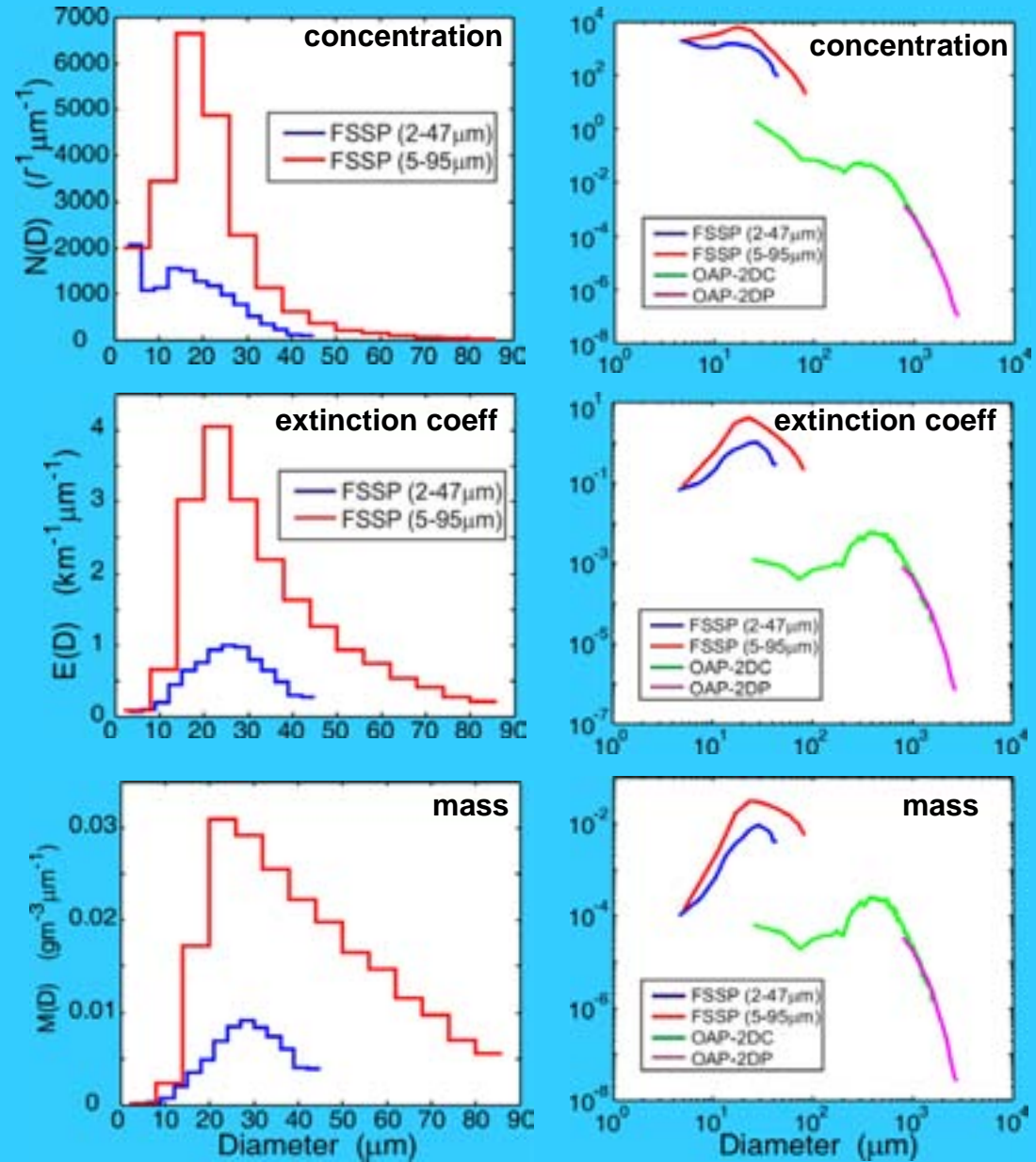
$$\beta_{OAP} = \frac{Q}{TAS * S} \sum image \ area$$

$Q \cong 2$ extinction efficiency

Liquid cloud



Ice cloud

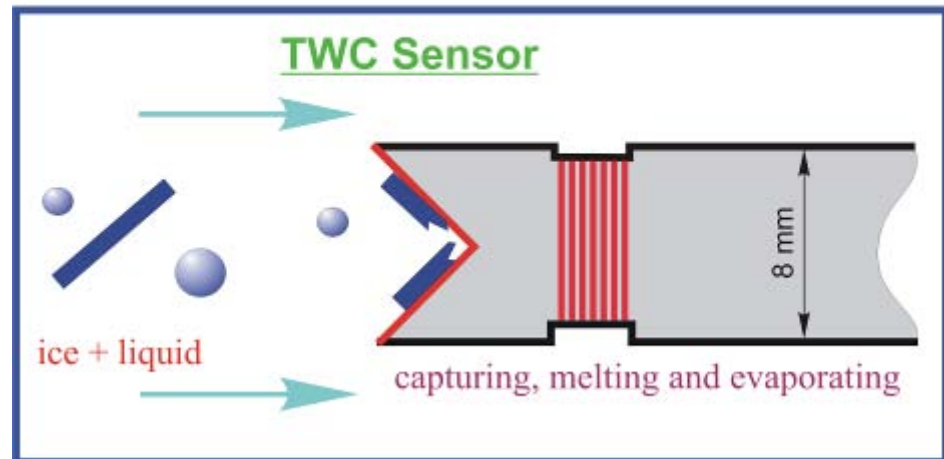
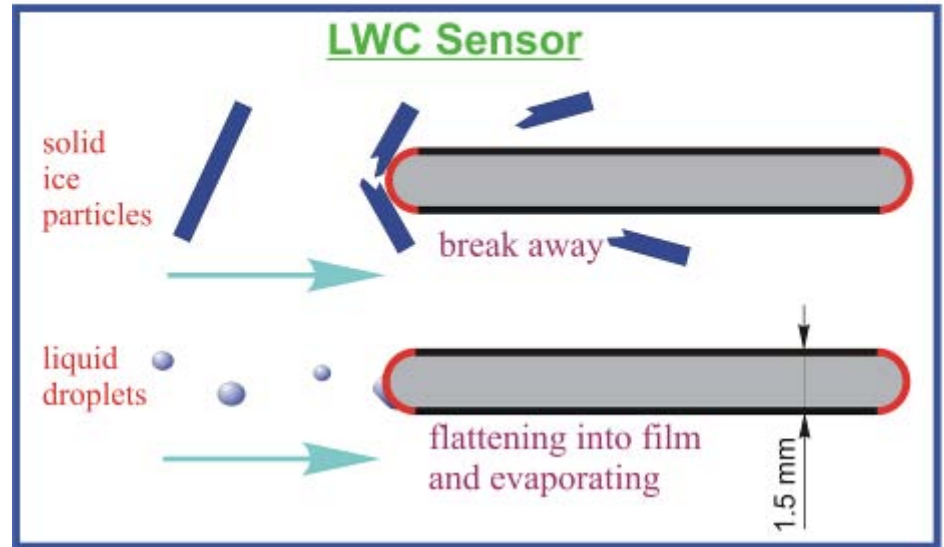


**What is the effect of bouncing
and shattering on hot-wire IWC
measurements?**

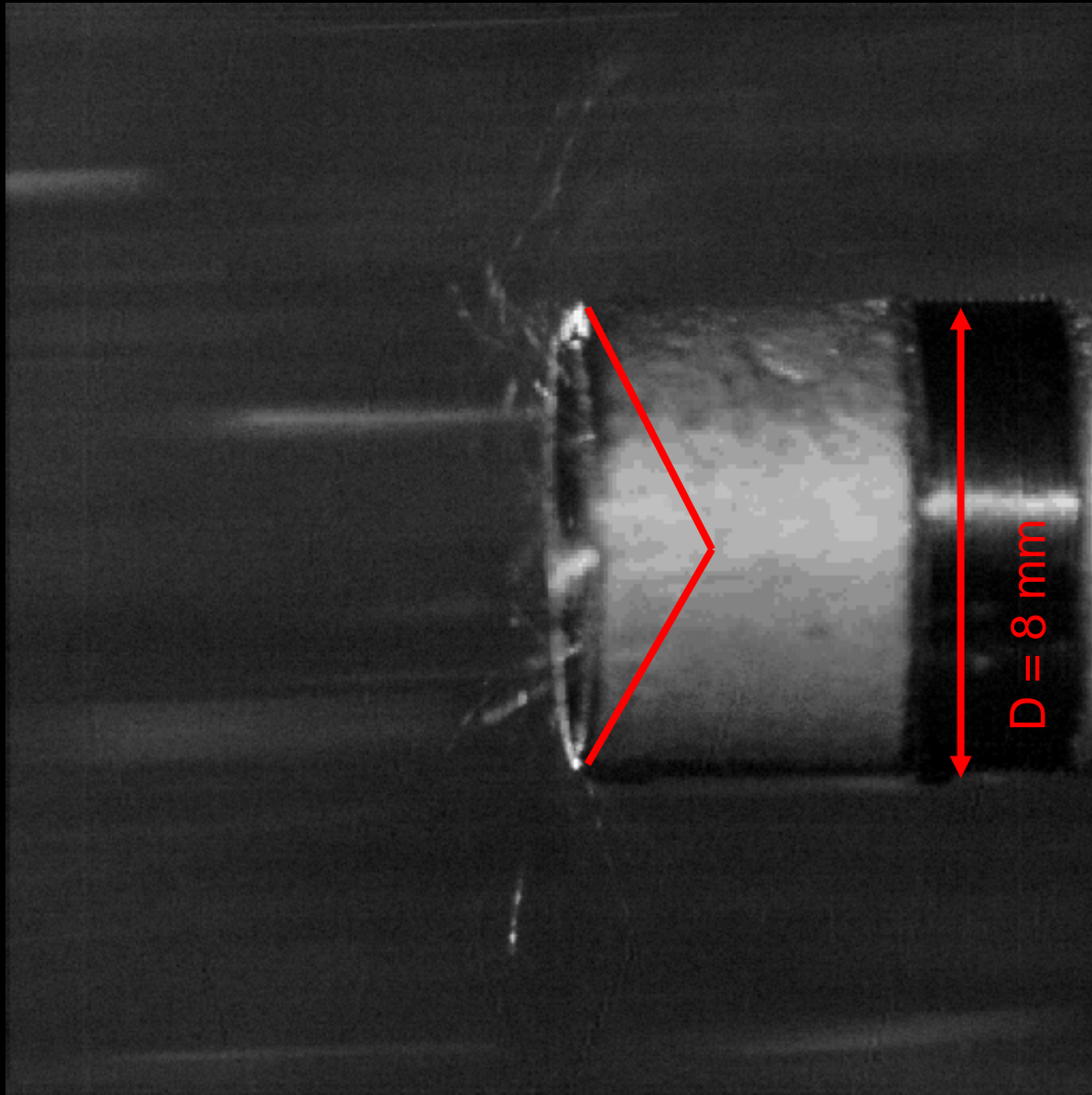
Nevzorov Probe



PHASE DISCRIMINATING CAPABILITY



Nevzorov TWC sensor (Shallow Cone)



Cox Wind Tunnel

NASA High Speed
Video

TAS=80m/s

Nevzorov Probe Mount for Convair-580 Tests

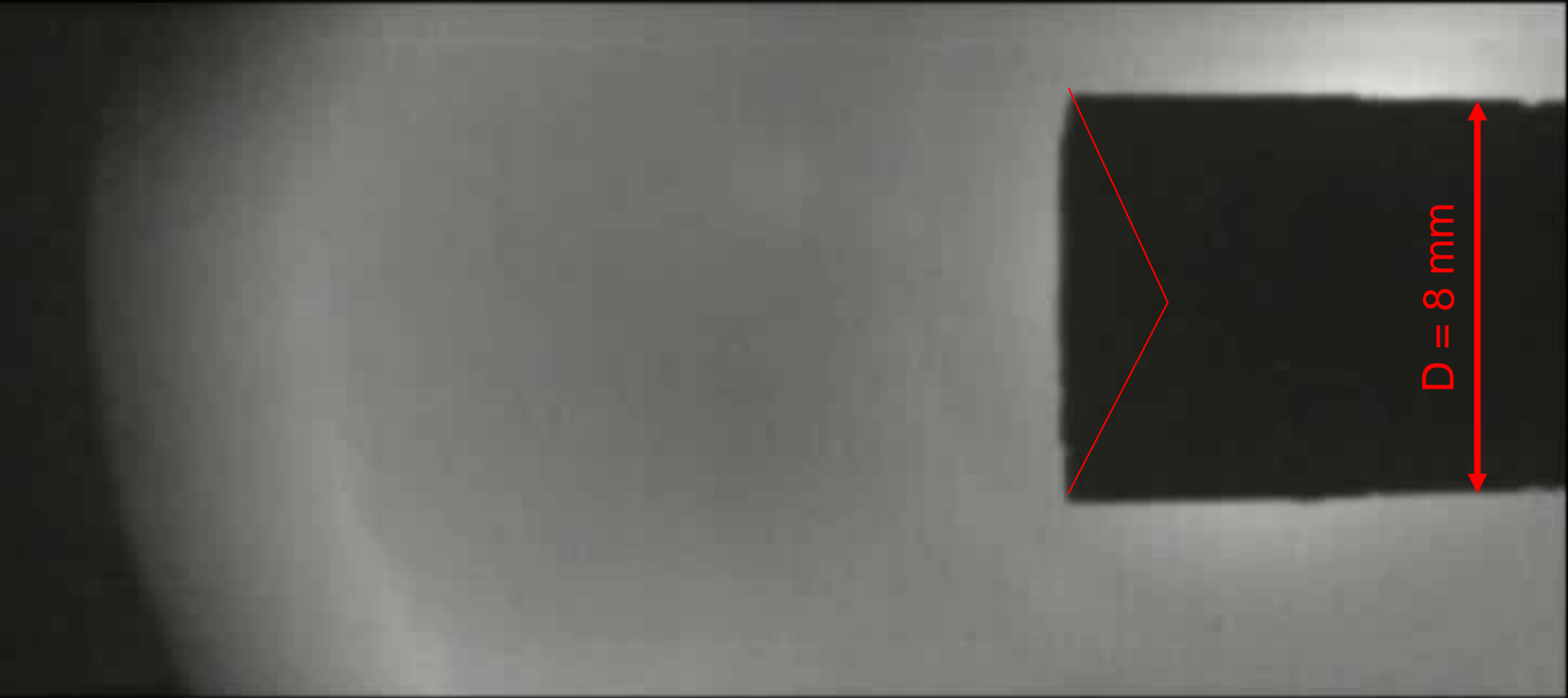


**Phantom V5.0 high
speed camera
inside cabin**

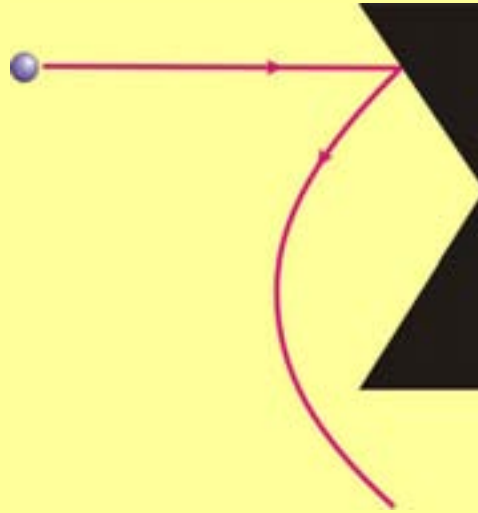


Inflight high-speed video (Convair 580)

1.5 mm spatial dendrite, -10.5°C , $\text{TAS}=100\text{m/s}$



Elastic bouncing



Inelastic impact & shattering



Nevzorov TWC sensor (Deep Cone)

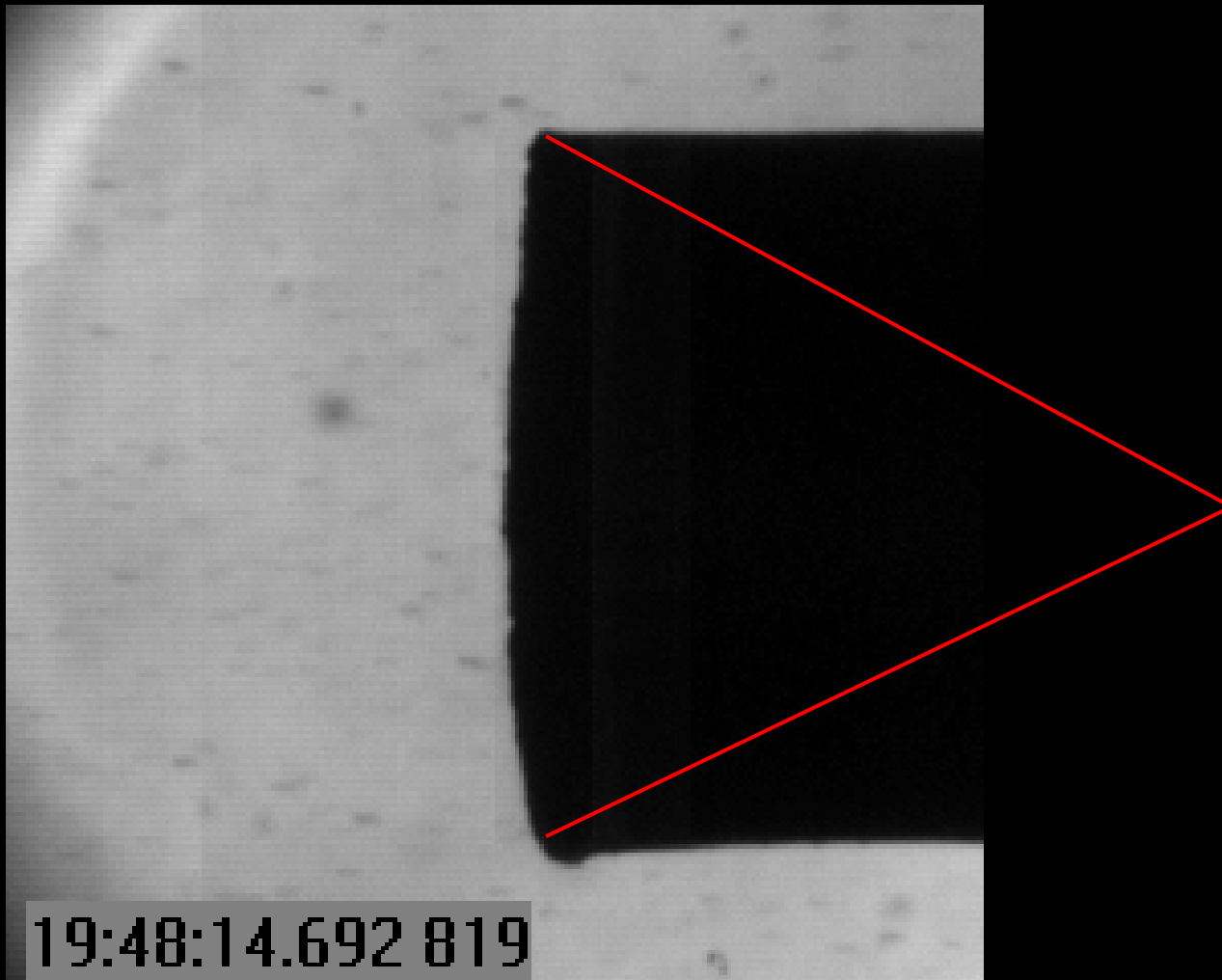
Cox Wind Tunnel

NASA High Speed
Video

TAS=80m/s

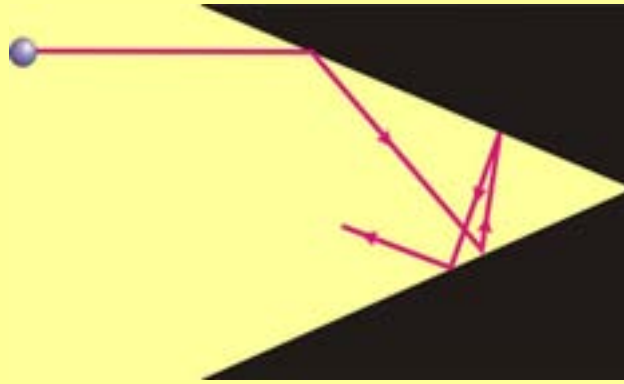
IWC estimated 1.7 g/m³

IWC measured 1.68g/m³

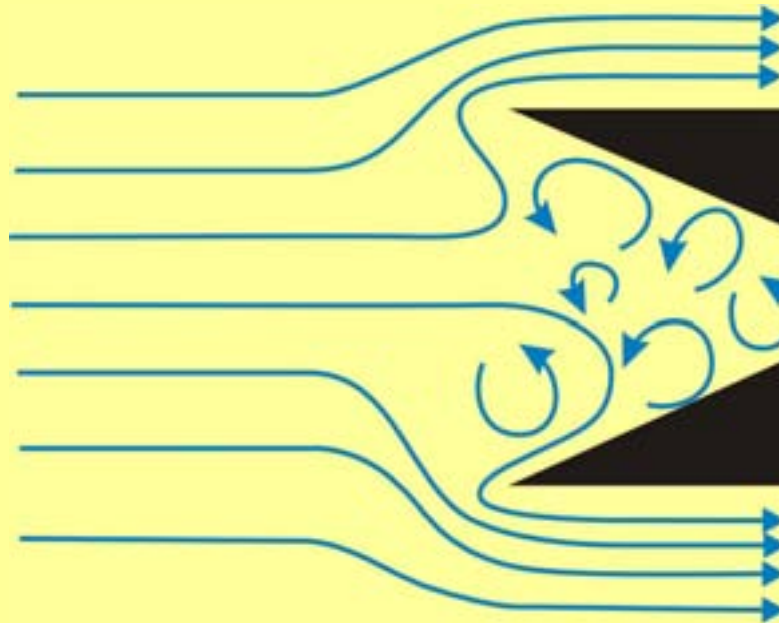


19:48:14.692 819

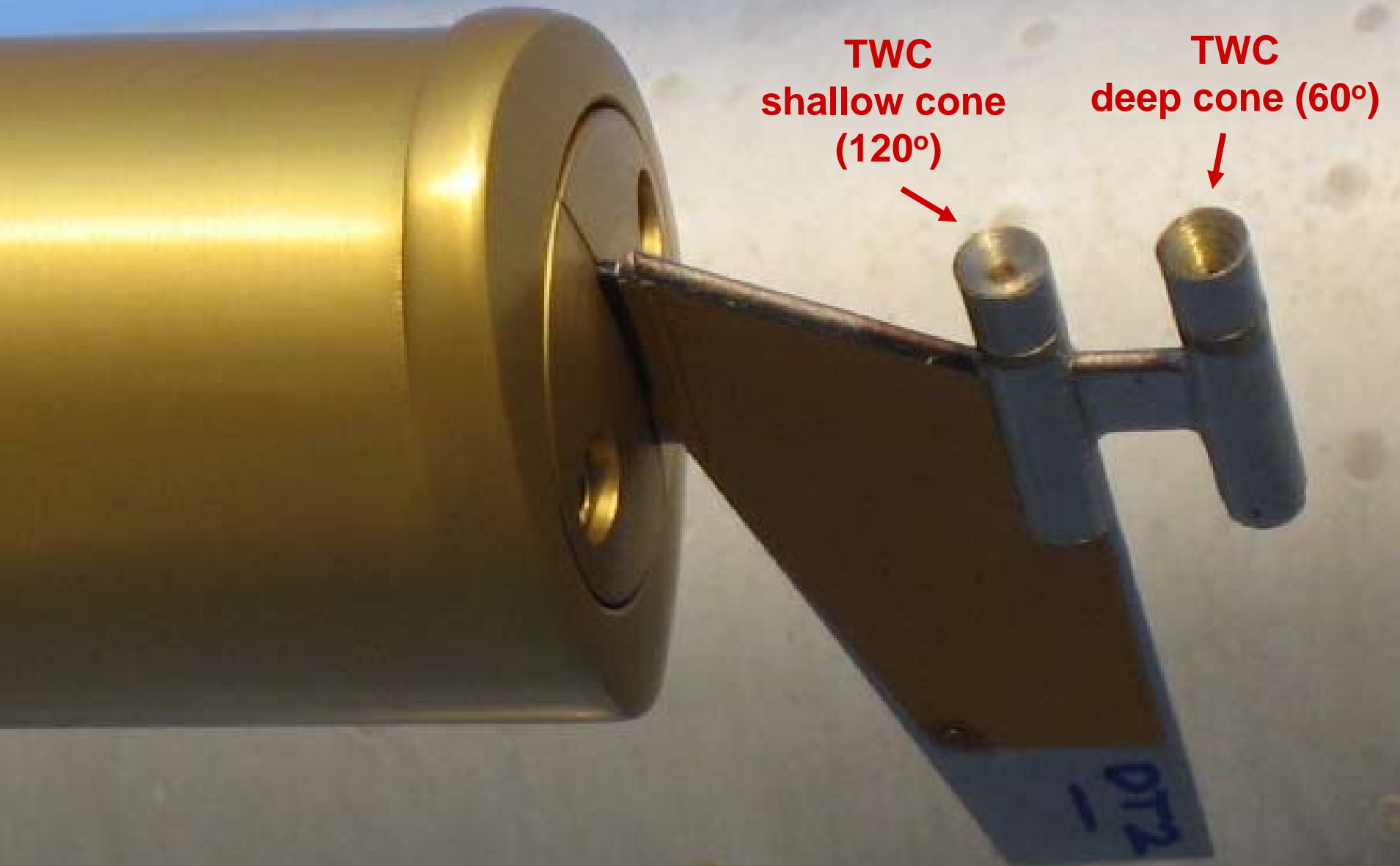
Elastic bouncing



Effect of airflow inside the cone



Modified Nevzorov Sensor Vane



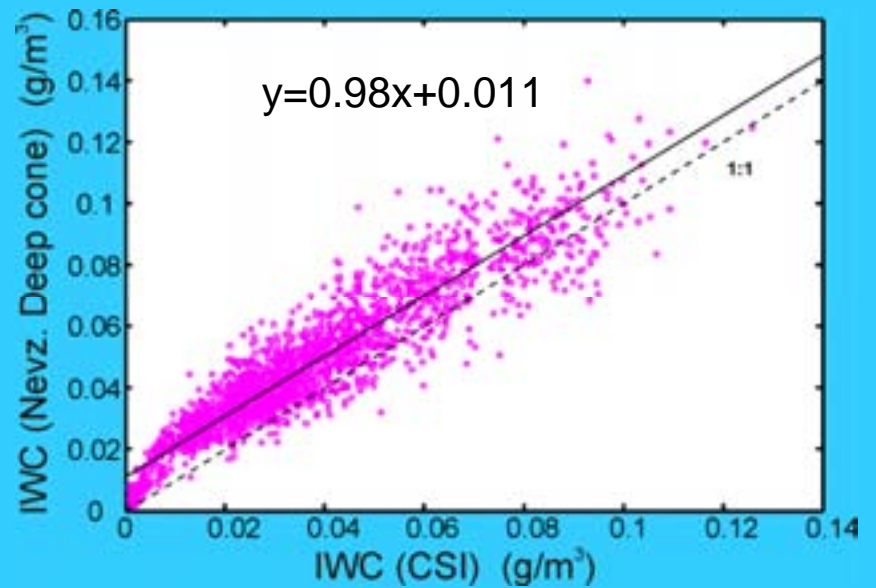
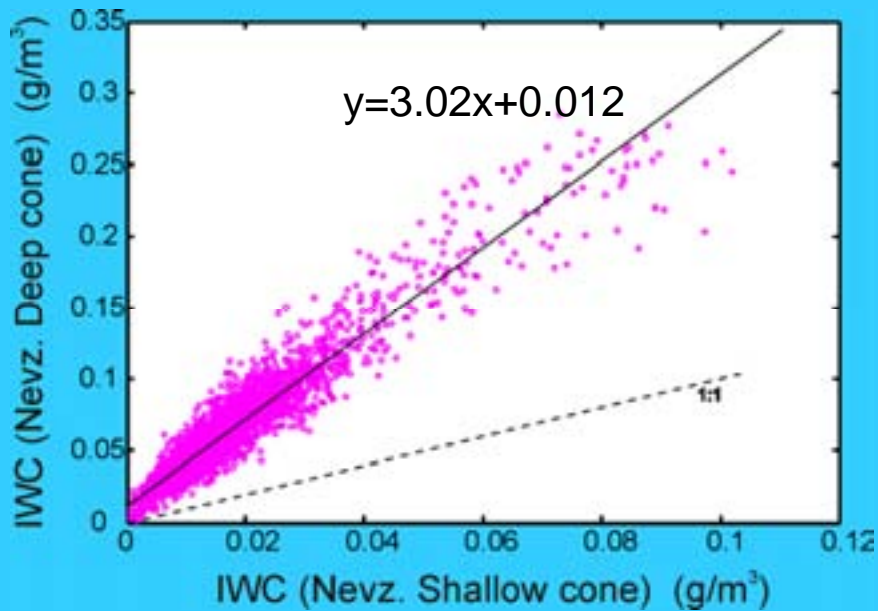
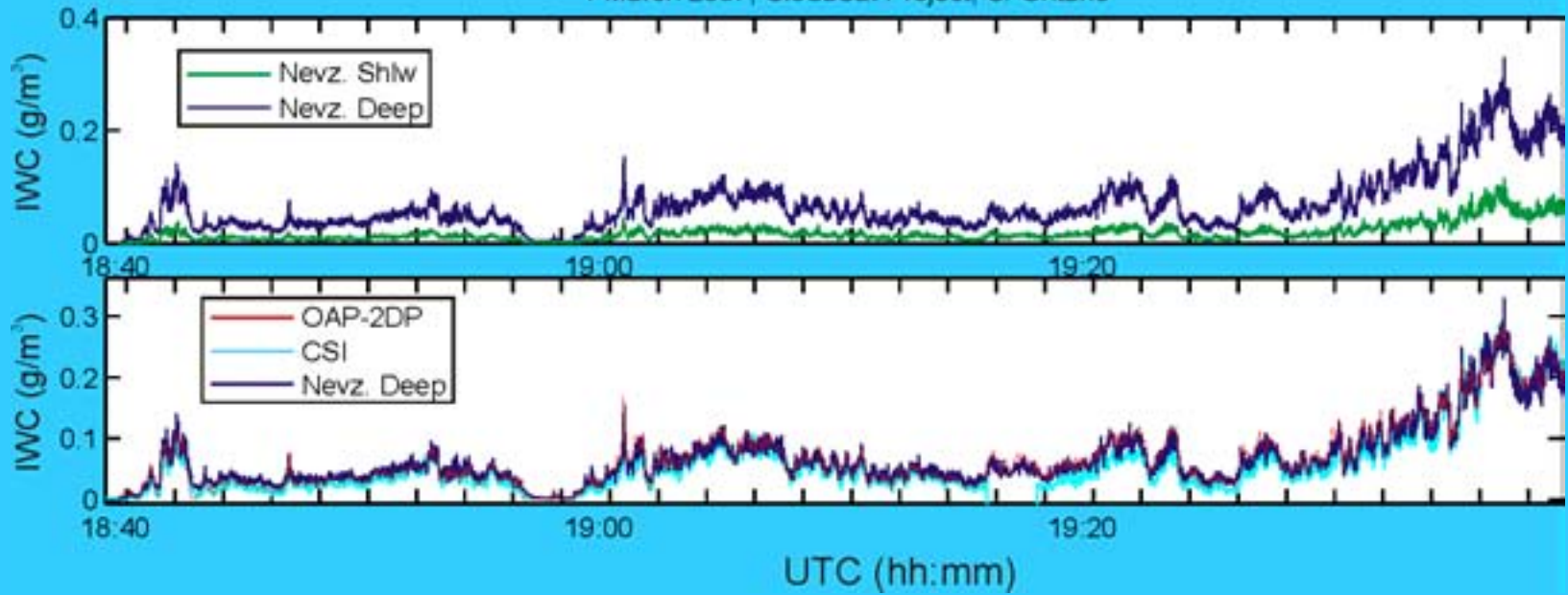
NRC Convair-580



Nevzorov probe



1 March 2007, CloudSat Project, S. Ontario



FINAL CONCLUSIONS

The shape of inlets and housings of the microphysical instruments is absolutely critical for adequate characterization of ice cloud environment from in-situ aircraft and wind tunnel measurements.

Currently used inlets may result in errors in measurements of concentration and mass of ice particles up to 5 times or even more.

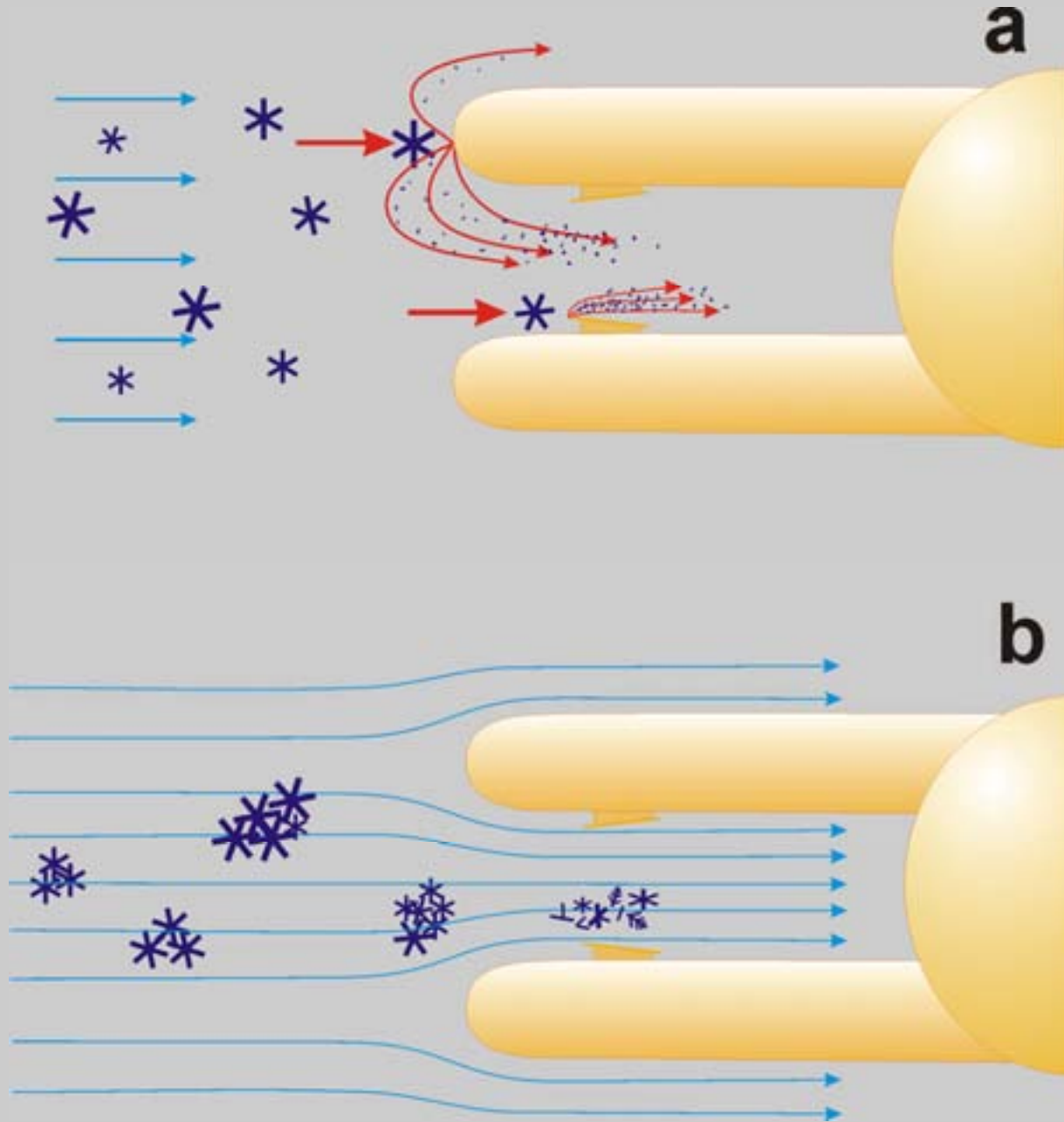
Funding Sponsors

- Transport Canada
- Canadian Space Agency
- NASA
- FAA
- National Research Council
- Environment Canada

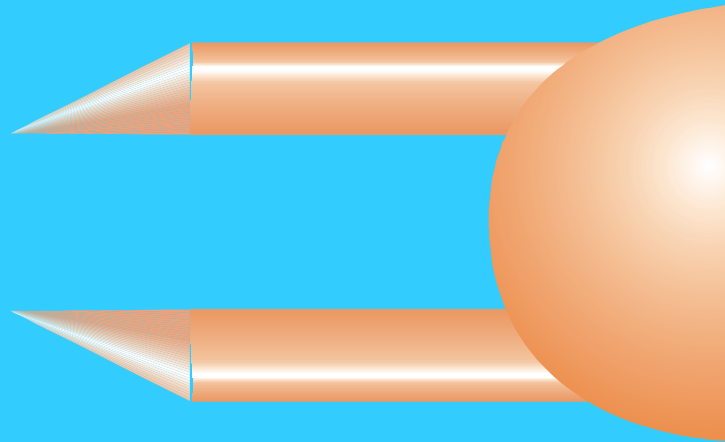
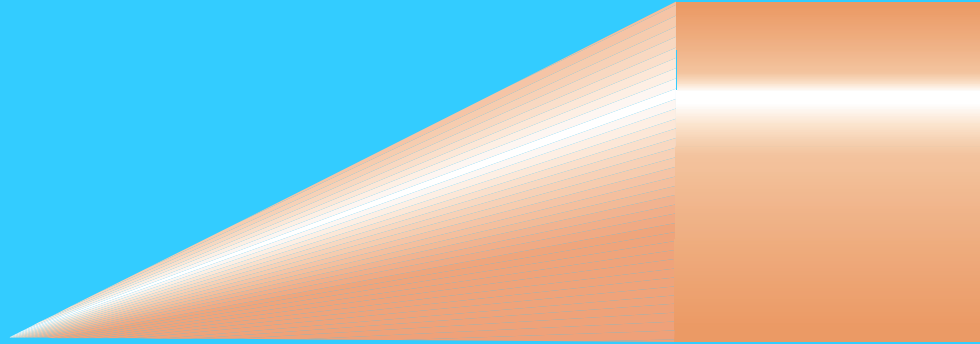
A photograph of a man with a beard and mustache, wearing a dark jacket and a watch, waving from the cockpit of a white airplane. The airplane has a prominent black and red stripe running along its side. The text "The End" is overlaid in a large, blue, serif font across the center of the image.

The End

Conceptual diagram of shattering

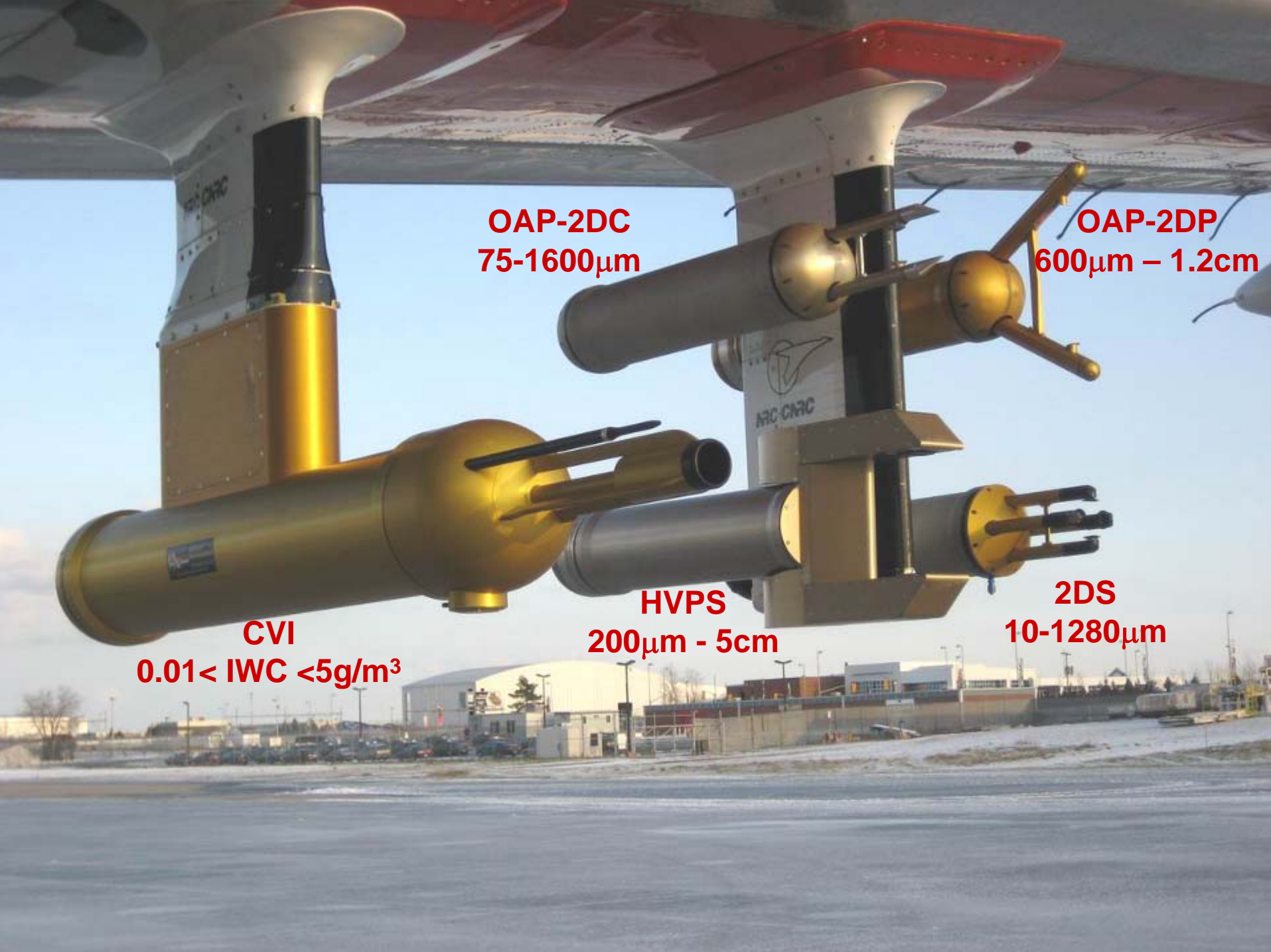


OAP-2DC tips with reduced shattering capability





ARC-CARC



OAP-2DC
75-1600 μ m

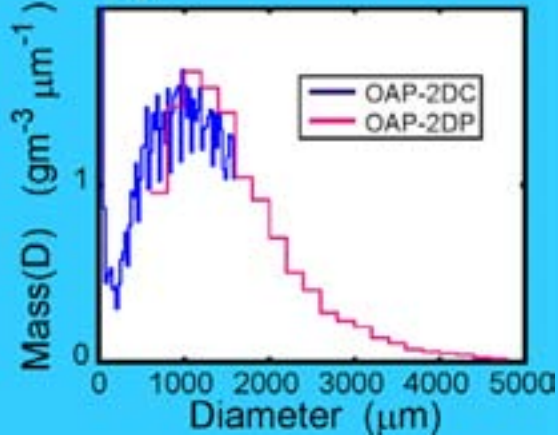
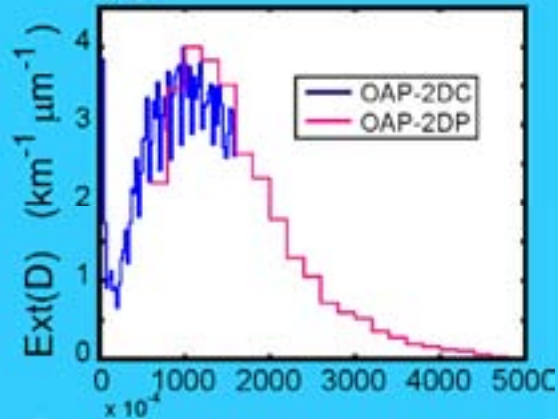
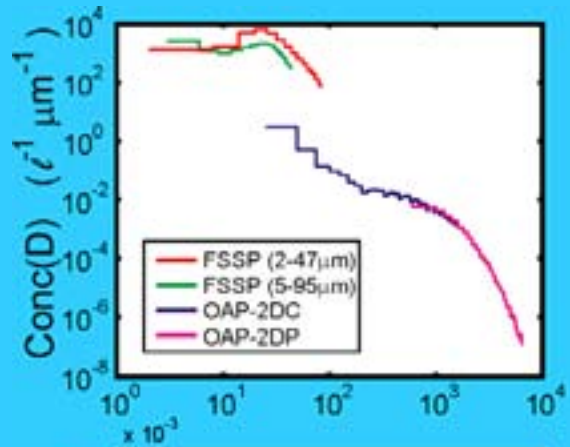
OAP-2DP
600 μ m - 1.2cm

CVI
0.01 < IWC < 5g/m³

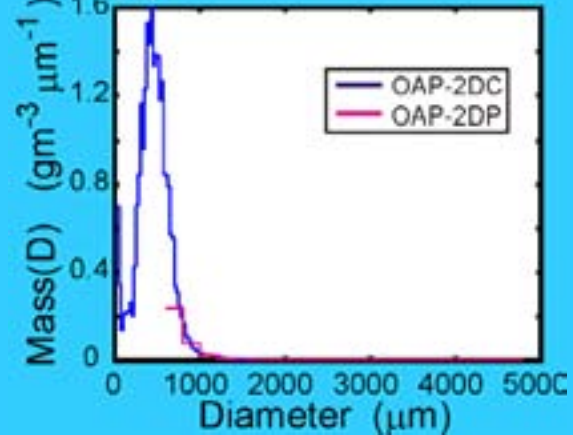
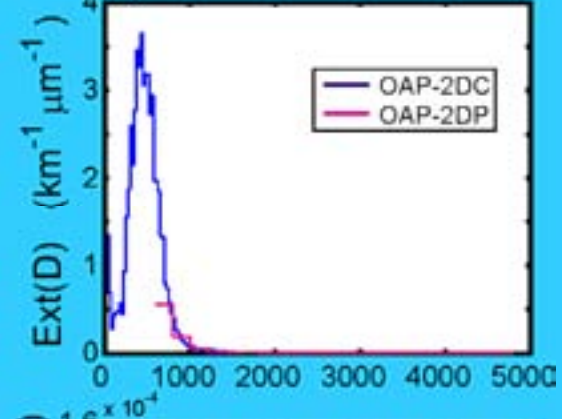
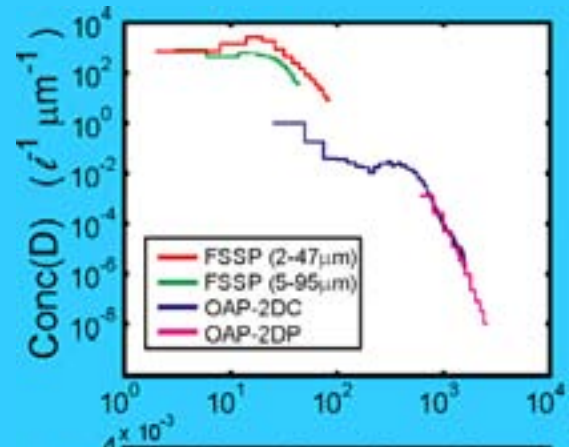
HVPS
200 μ m - 5cm

2DS
10-1280 μ m

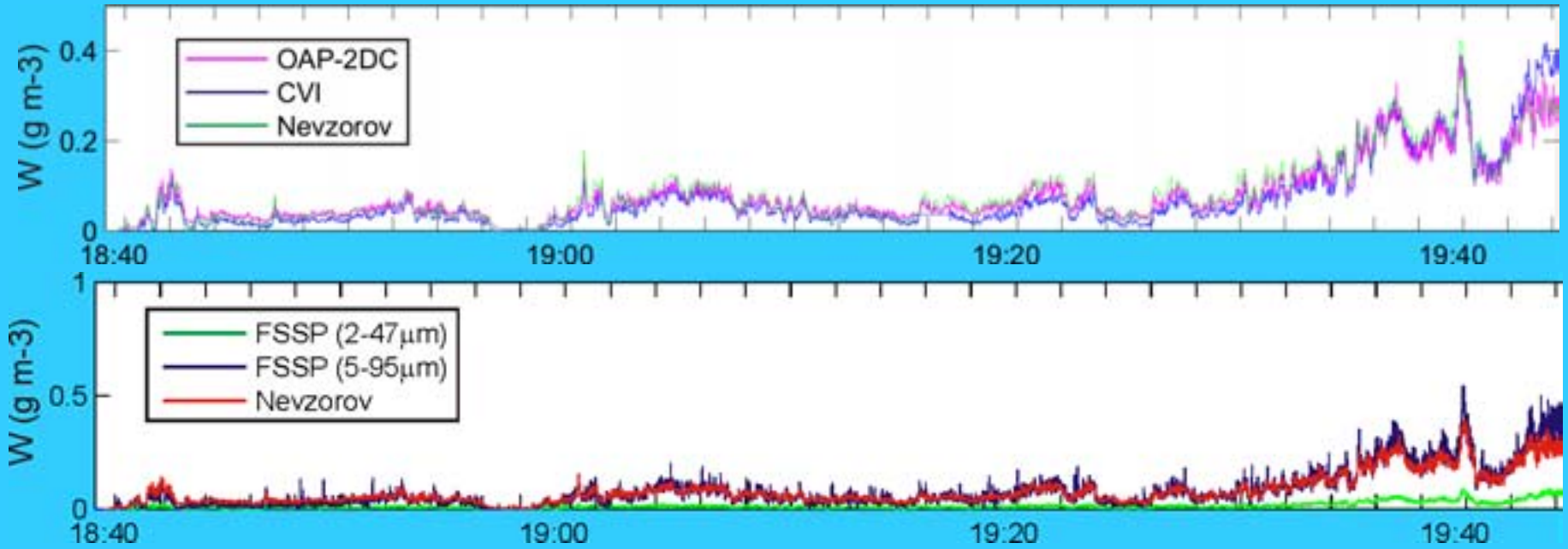
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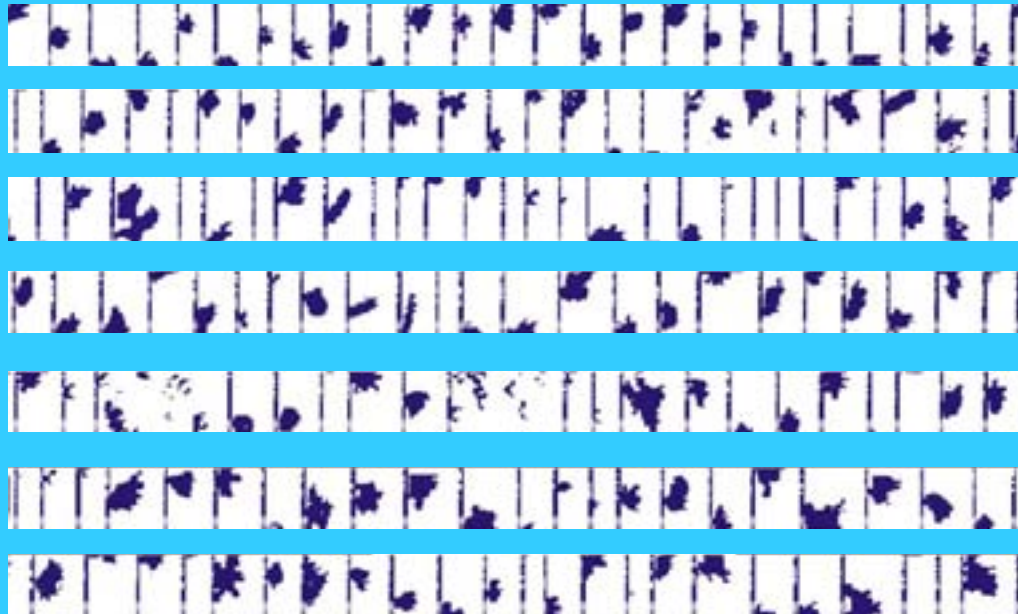
01 March 2007 UTC 18:44:41 - 19:00:08



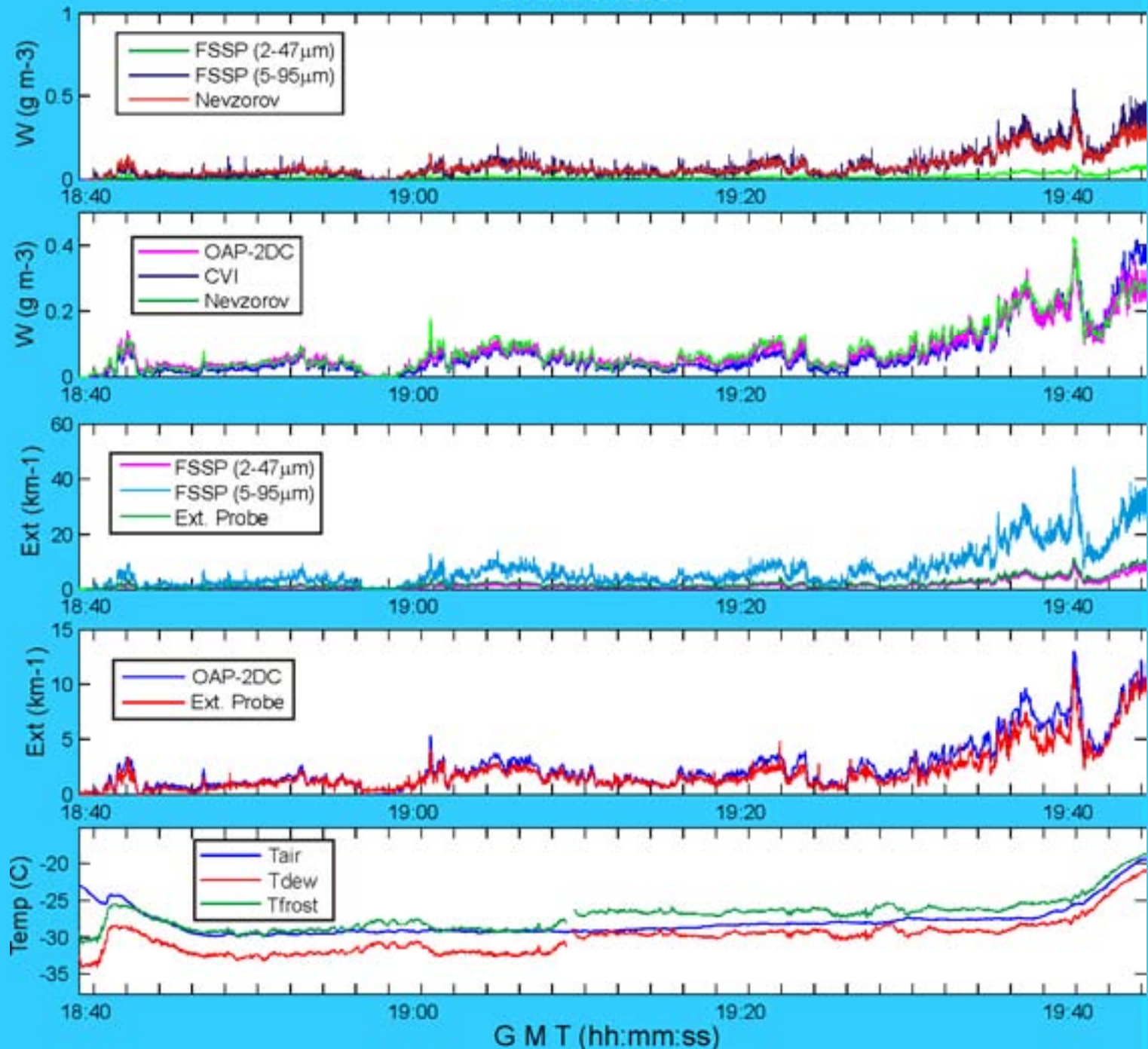
01 March 2007, CloudSat Project, S. Ontario



OAP-2DC 19:25:31.61



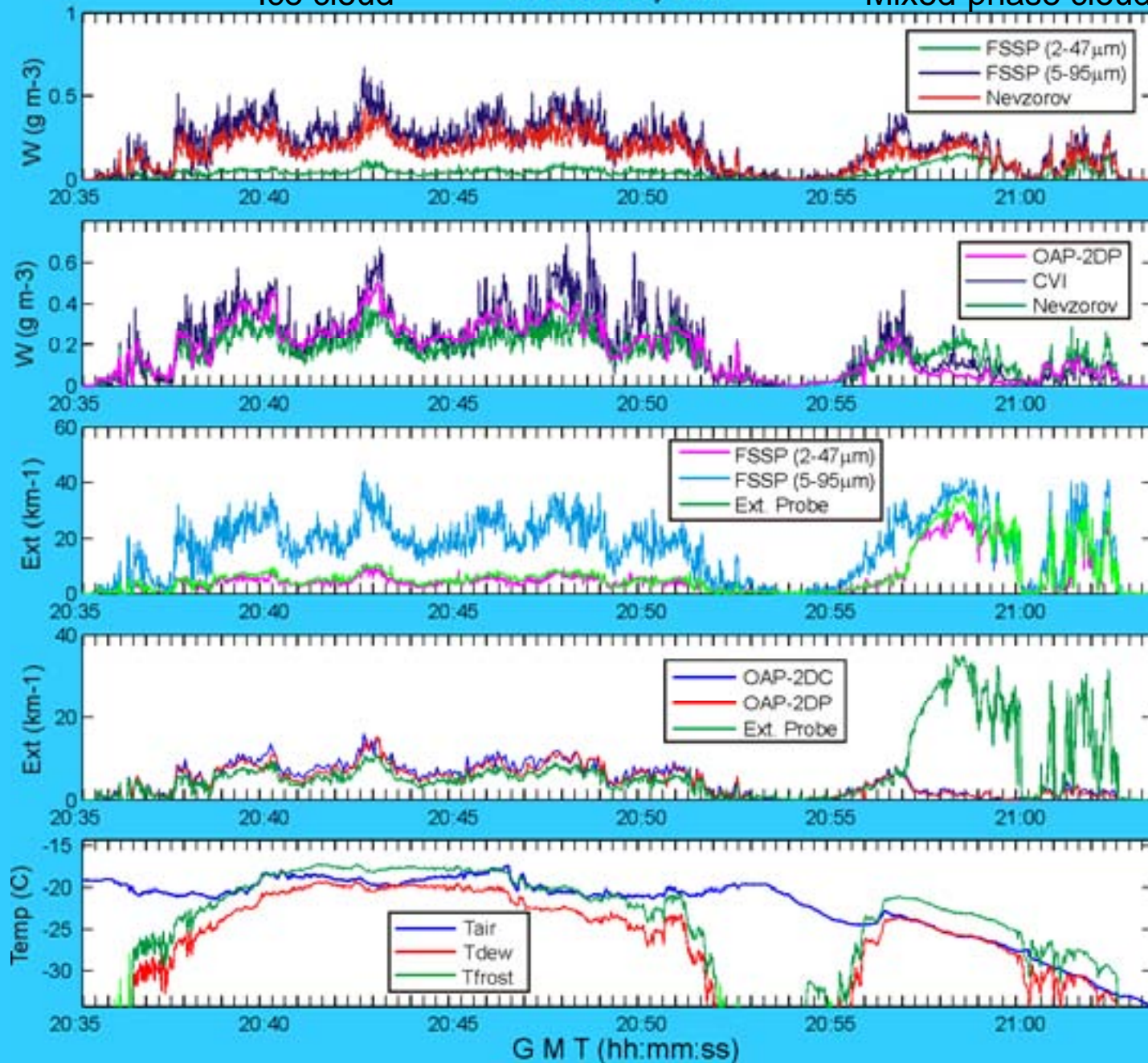
01 March 2007



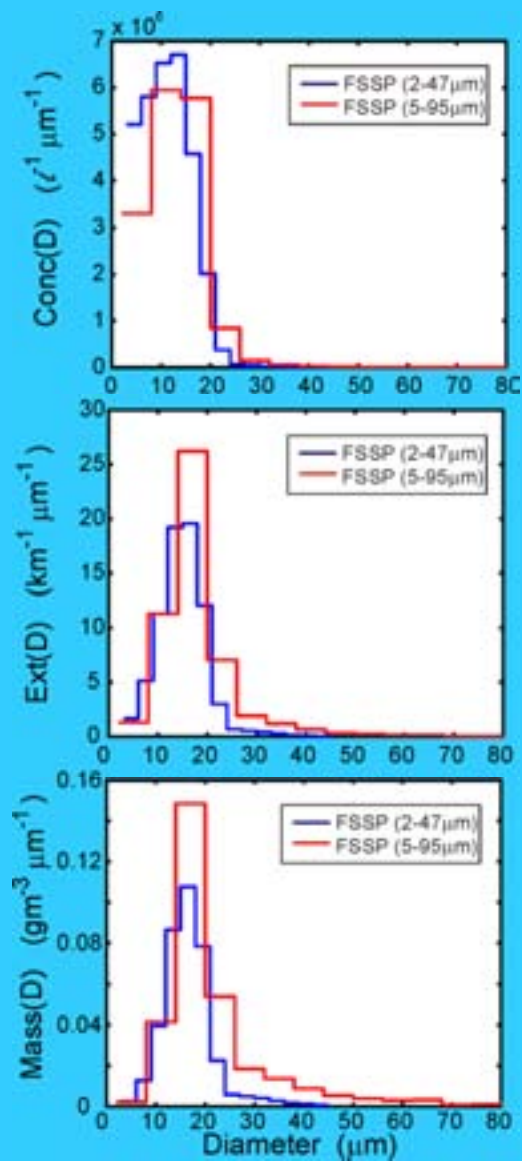
Ice cloud

25 February 2007

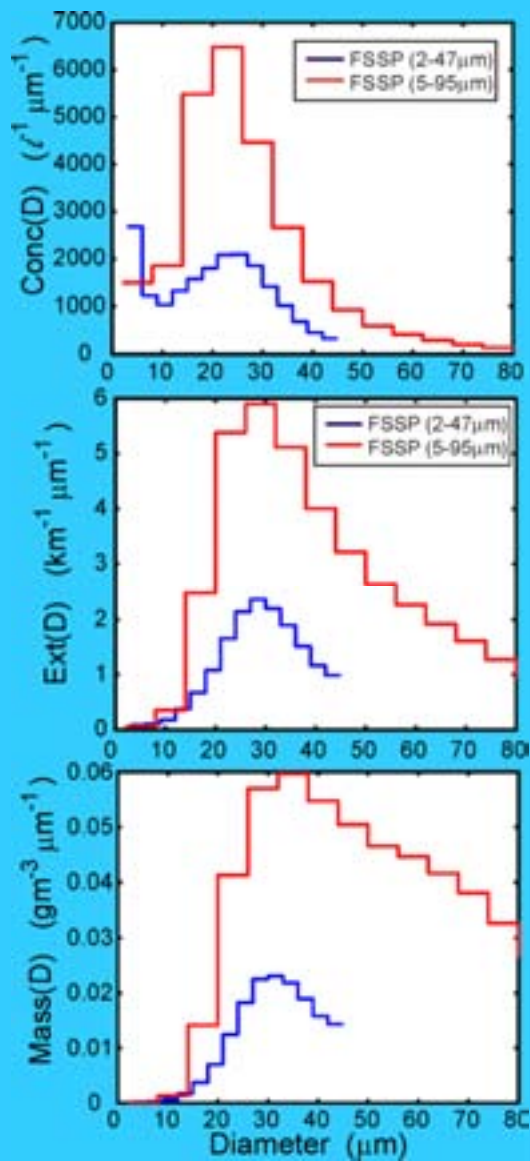
Mixed-phase cloud



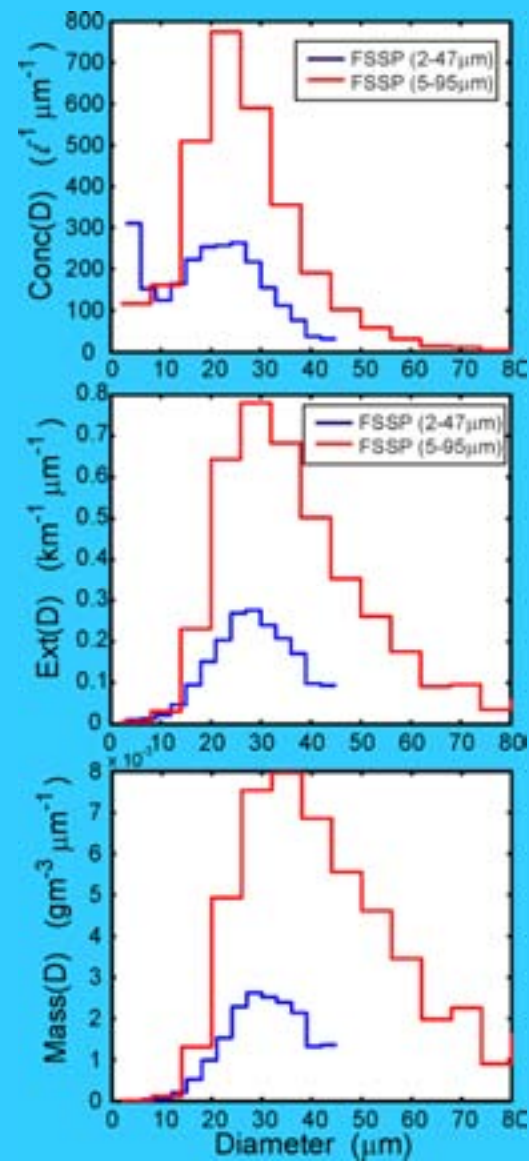
Liquid cloud



Ice cloud RHi>100% (growing)



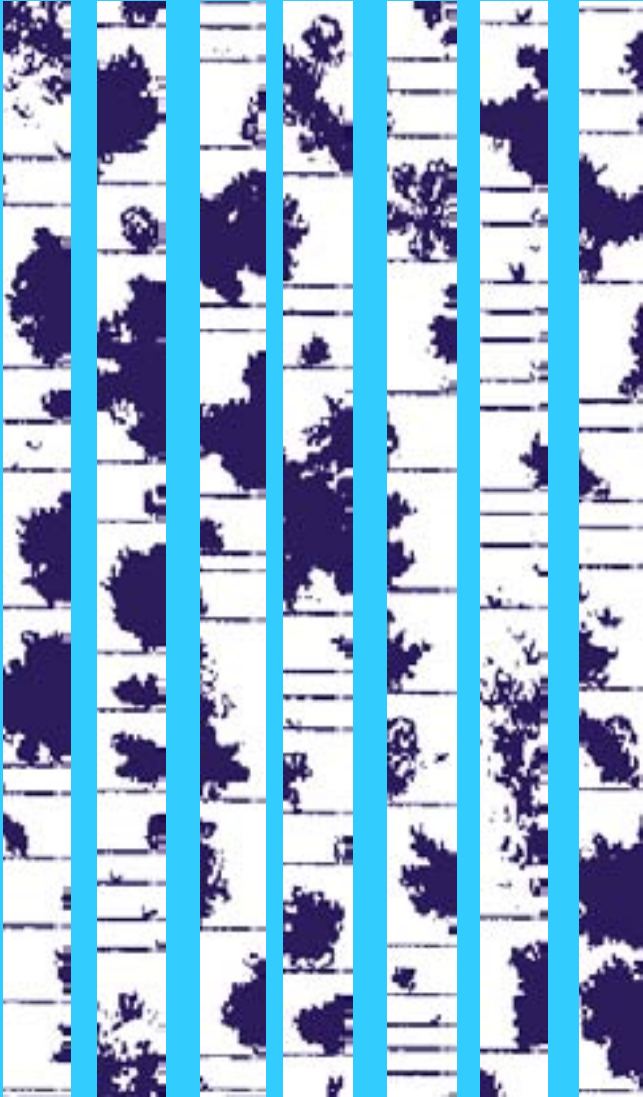
Ice cloud RHi<100% (sublimating)



25 February 2007

01 March 2007

OAP-2DC 20:42:43.60



OAP-2DC 19:25:31.61

