

AFLUX Flight #03 – 21 March 2019

Mission PI P5: Christof Lüpkes

Objectives:

The flight had two goals. The first was to obtain data for the noseboom calibration. The second was to measure the cloud structure and impact on the fluxes over sea ice northwest from Svalbard.

Crew:

| Polar 5 | |
|------------------|-------------------------------------|
| PI | Christof Lüpkes |
| Basis Data Acq. | Cristina Sans Coll |
| SMART/Eagle Hawk | Michael Schäfer |
| Cloud Probes | Yvonne Boose |
| MiRAC | Mario Mech and Leif Leonard Kliesch |
| AMALi | Mario Mech |

Flight times:

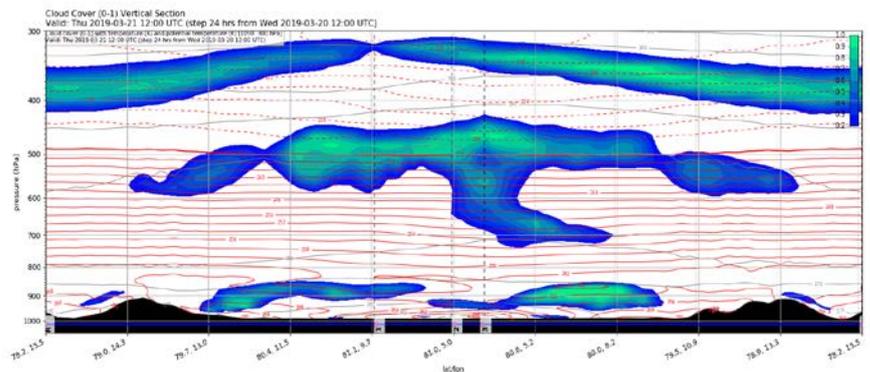
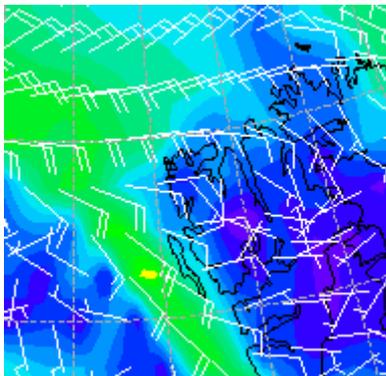
| Polar 5 | |
|------------|-----------|
| Take off | 09:50 GMT |
| Touch down | 15:30 GMT |

Overview:

The strategy of this flight was to calibrate the noseboom measurements for different angles of attack by flying a low-level leg with variable speed. Another calibration followed by repeating one section in opposite flight direction. Then a first staircase pattern was flown to obtain vertical profiles of fluxes. Some sections in high altitude followed to obtain measurements above clouds.

Weather:

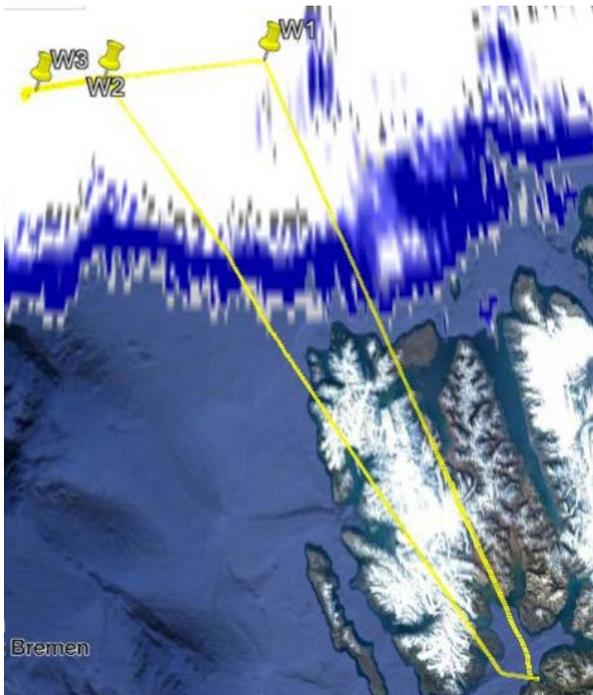
Both GFS and ECMWF predicted winds from southeast in the measurement region north of Svalbard while the cloud prediction of both models differed from each other. GFS predicted no clouds, ECMWF predicted a high fraction of low clouds.



The left figure shows the near-surface wind vectors as predicted by GFS. The right one shows the clouds predicted by ECMWF.

The observed low clouds agreed in the measurement region roughly with the ECMWF prediction. However, there were only very few (2/8) mid level clouds in the measurement region (W1→W3), which was in contrast to both ECMWF and GFS.

Flight track and pattern:



The Figure shows the flight track with the three waypoints. Between W1 and W2 the first calibration was performed.

A staircase pattern followed between W2 and W3.

Detailed Flight Logs:

Clouds

Only few clouds occurred over Svalbard, but almost 8/8 low SC cloud cover started over the open water region north of Svalbard (Whalers Bay polyna) and this cloud fraction did not



change in the sea ice covered part of the flight. The photo shows the typical conditions in the measurement regions. During the whole distance W1→W3 cloud tops were at about 5000 ft,

the cloud base was at W1 3200 ft and at the other Waypoints it was difficult to distinguish regions with precipitation reaching the surface from cloud base. Between W2 and W3 cloud base might have been at 2200 ft but also in some parts also near the surface. Thus visibility during the legs was variable. Icing occurred in the upper third of the clouds so that a slow descend rate as planned originally at W1 was not possible.

Sea ice conditions



Photos: Typical conditions with floes (bottom) and new ice areas (top)

The estimated sea ice cover was about 98% between W1 and W3. It consisted of thin, first-year ice (estimated thickness often below 1 m) with mostly drifting floes of about 500 m diameter. Several refrozen leads (white nilas) were crossed but the ice thickness on those leads did not differ much from that of the drifting floes so that it was difficult to clearly identify the leads. Only one larger open lead of about 500 m width occurred between W1 and W3 and this was at the western end of the track near W3, so that the measurements were

probably not influenced. On the way between W2 and LYR the 98 % ice cover decreased until the ice edge with about 50 % ice cover was reached at 80.5 N.

Detailed notes during the flight, heights of flight legs

W1→W2: leg at 200 ft, first calibration for noseboom (speed change from 80 to 140 to 80 Kn). The rest of this leg and all remaining legs with measurements were flown with 120 kn. Between W2 and W3 a staircase pattern was flown (leg 1: 200 ft leg 2:200 ft, leg 3: 600 ft, leg 4: 1200 ft., leg 5: 1200 ft, leg 5: 1200 ft, leg 6: 2500 ft, leg 7: 3500 ft. The latter leg 7 had to be interrupted roughly at half the distance because of heavy icing. We climbed to 10.000 ft and flew a last leg at this level. During this level radar observed precipitation reaching the ground. Then, at W2 we went down to 200 ft heading to LYR. After we reached 8.5 N we climbed up to 10.000 ft.

Drop sonde

No drop sondes were thrown.

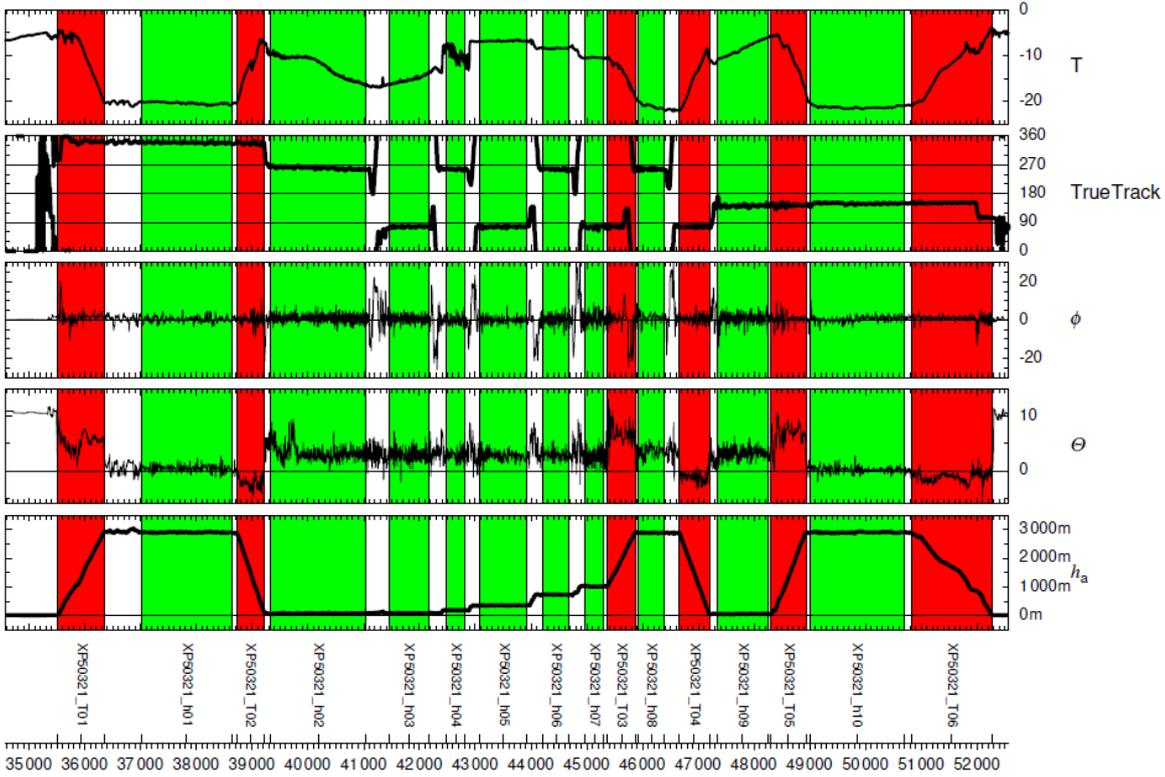
Instrument Status:

Licor had problems with icing after about half of the flight. One humicap did not work at all.

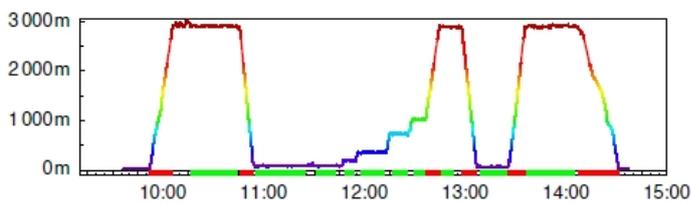
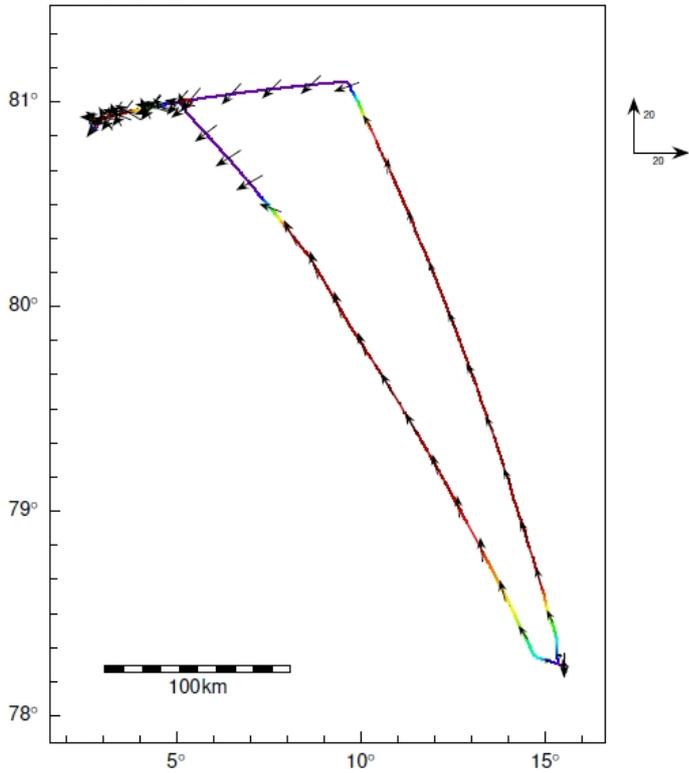
| Polar 5 | |
|------------------------|--|
| Basis data acquisition | |
| Nose Boom | |
| MiRAC | |
| AMALi | |
| SMART | |
| Eagle/Hawk | |
| Cloud Particale Probes | |

Quicklooks:

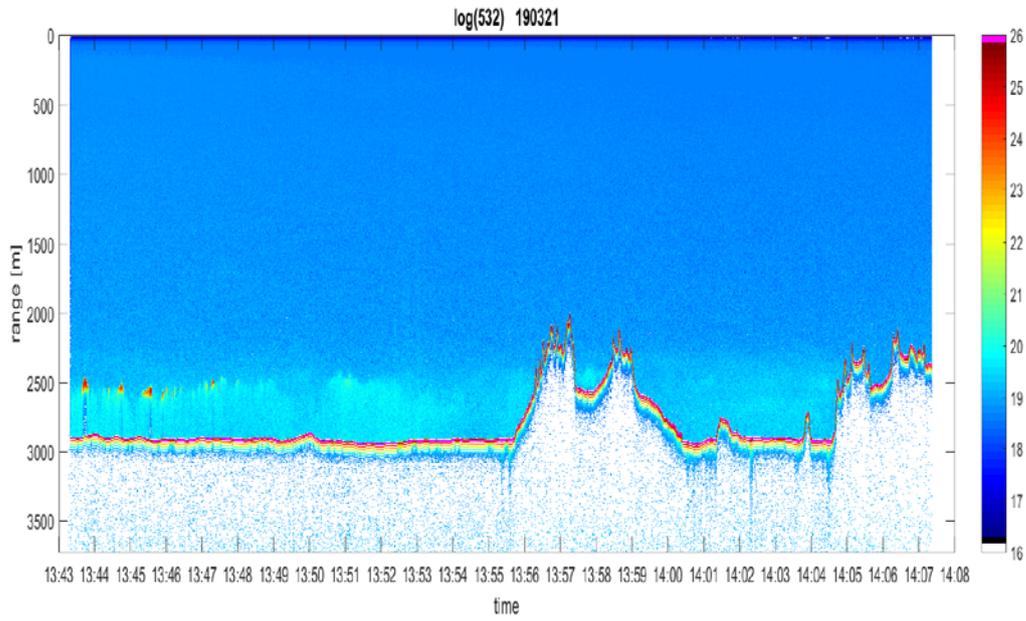
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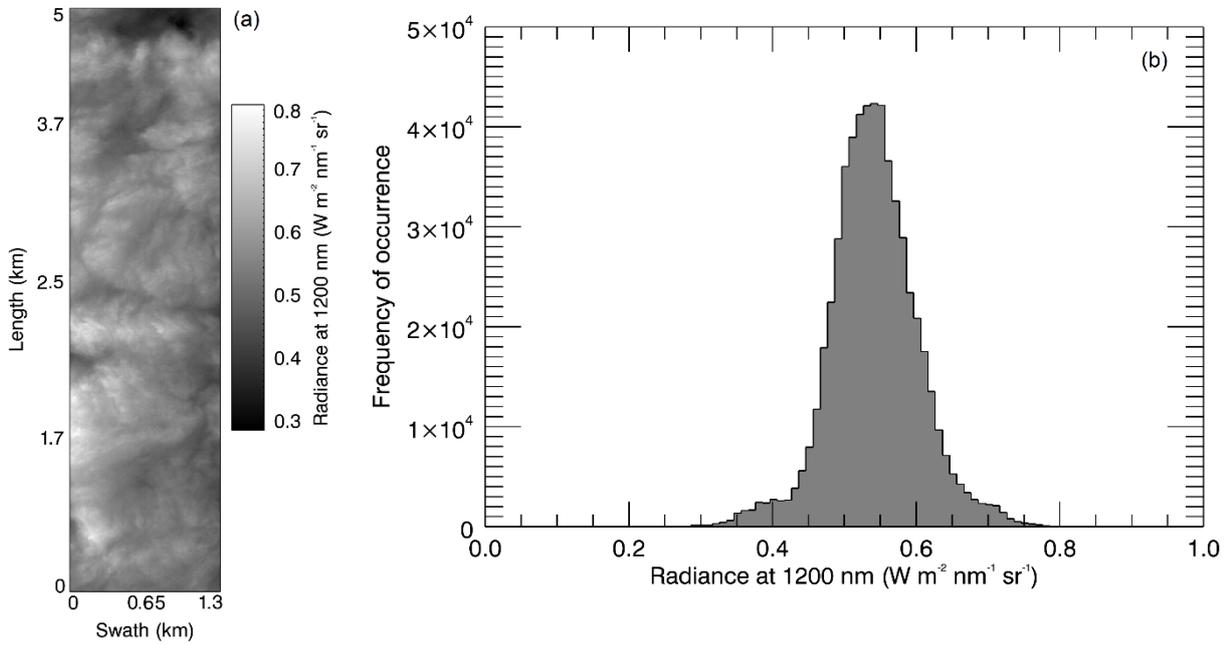
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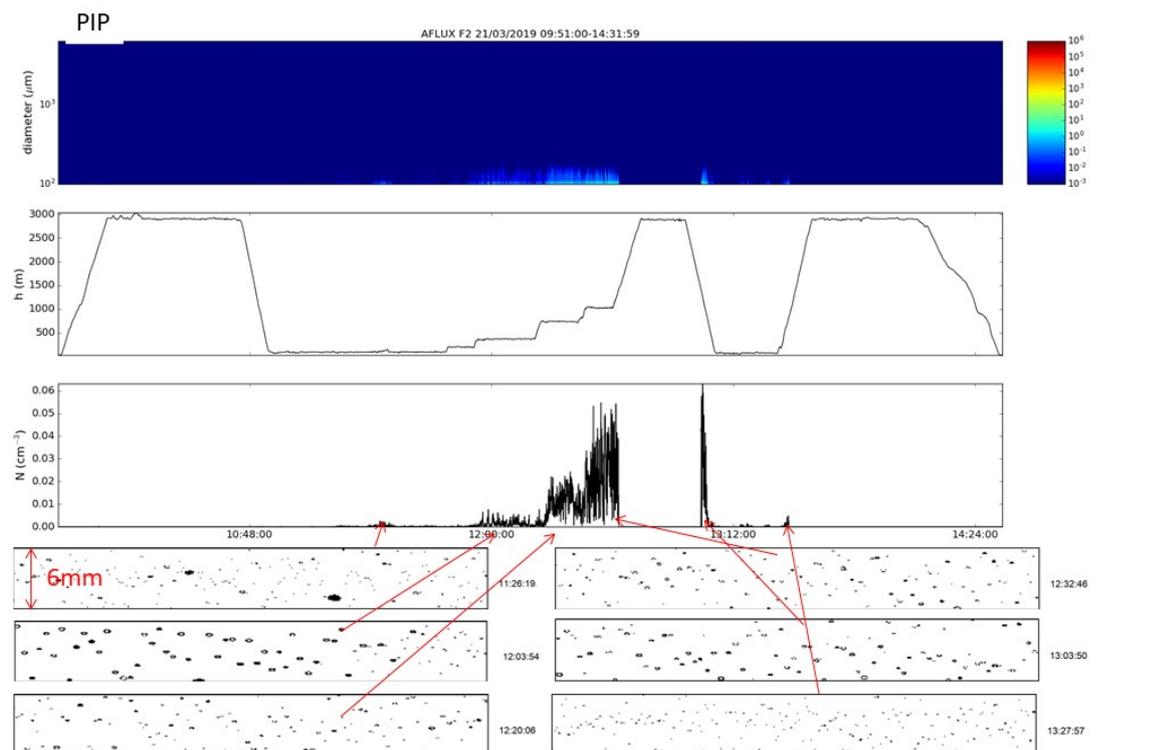
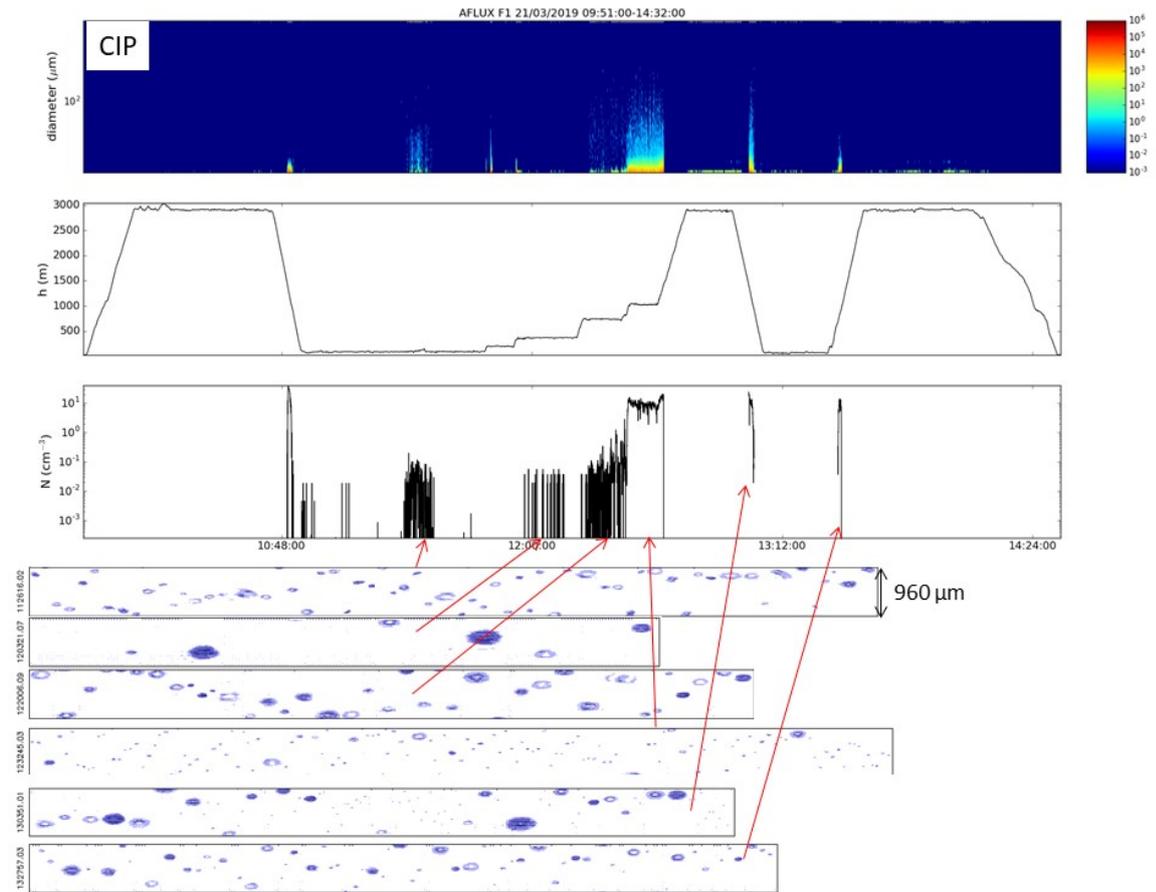
Examples of AMALI measurements.



Results of the nadir pointing AisaHAWK (bottom) showing a map of cloud top reflected radiance at 1200 nm wavelength.

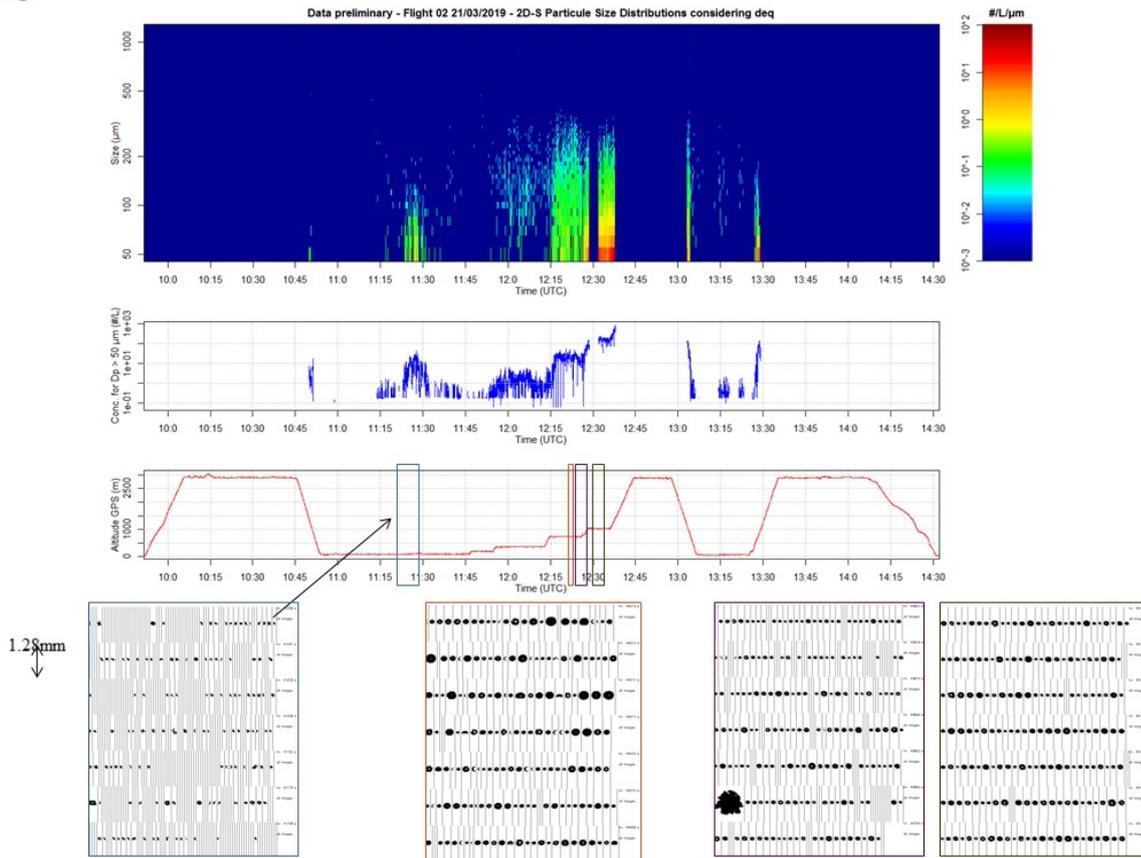


Results of DLR cloud probes (Cloud Imaging Probe and Precipitation Imaging Probe)



Results of the LaMP Cloud Probes (Polar Nephelometer and 2D-S)

2D-S



PN

