

HALO-(AC)³ – 2022/03/28 – Polar6 research flight RF05

Objectives:

RF05 with Polar 6 covered 3 topics: (1) the intensive probing of the evolution of a moderate oceanic cold air outbreak event southwest in the lee of Svalbard, (2) coordinated P5 underpasses on three flight legs and (3) two HALO underpasses.

These topics motivated the selection of the flight route.

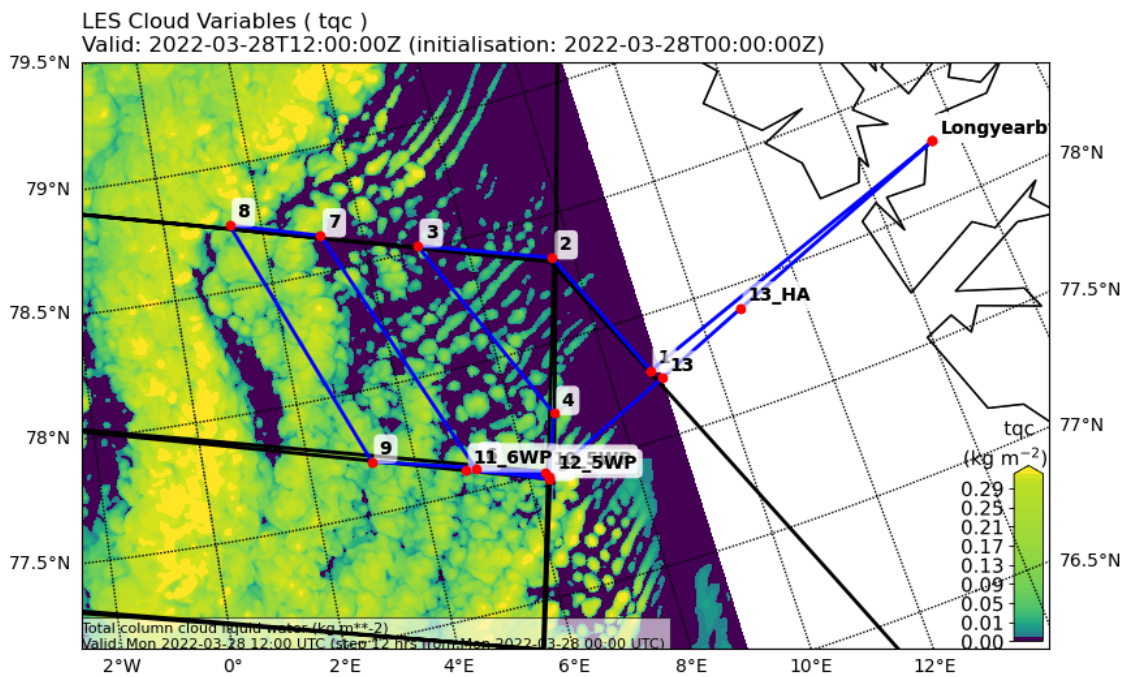
Mission PI P6:

Christiane Voigt (Christiane.Voigt@dlr.de)

Polar 6 Crew	
Mission PI	Christiane Voigt
Basis Data Acq.	Maximilian Stöhr
CVI	Sarah Grawe
ALABAMA/Trace gas	Hans Christian Clemen
Microphysics	Johannes Lucke
HERA/Aerosol	Bruno Wetzel

Flight times:

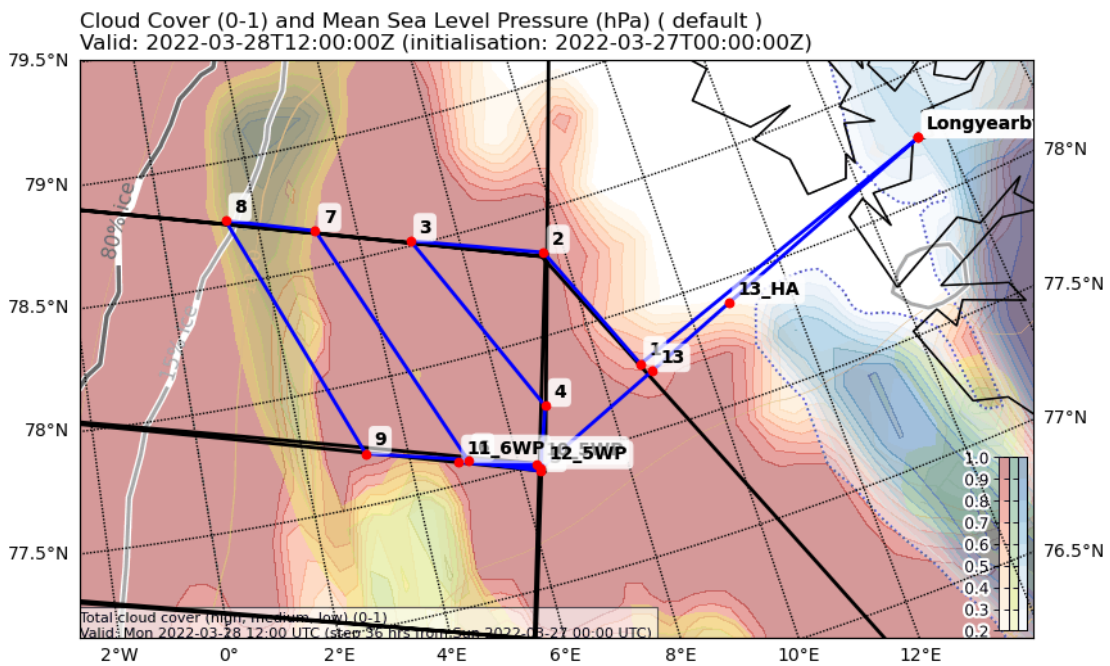
Polar 6	
Take off	11:28 UTC
Touch down	16:18 UTC

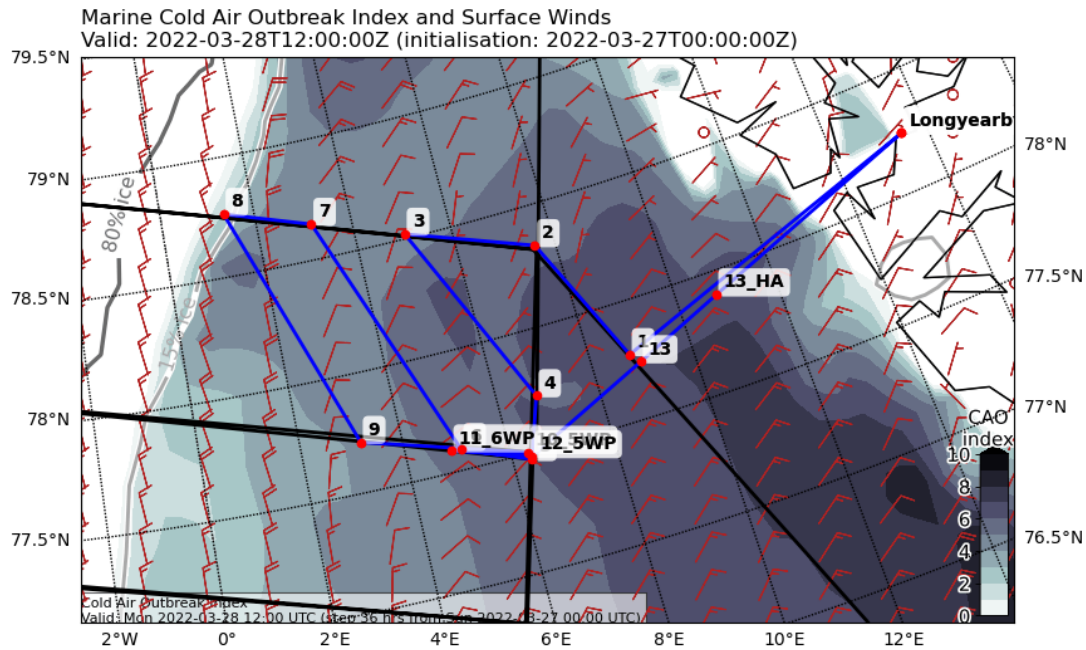


Weather situation:

Weather situation 2022-03-28 (by Benjamin Kirbus):

Combined with a low-pressure system located in the southeastern Barents Sea, this created a weak northeasterly flow at the surface of Fram Strait. With increasing altitude, this shifted more towards an easterly flow regime. Accordingly, a rather weak cold air outbreak developed west and south of Svalbard. It was the goal of the P6 to probe the evolution of this cold air outbreak with the P6 in-situ instrumentation and the P5 above. In Fram Strait, almost exclusively low clouds were found which had originated from the northeastern tip of Greenland and the central Arctic. In contrast, the area between Kiruna and Svalbard additionally sampled by HALO was characterized by some mid and higher level clouds. These were remnants of a dynamic low pressure system that had previously drifted from Iceland towards the Norwegian coast.





P6 planned flight track, cloud cover and CAO index for Monday 12 UTC from ECMWF

Cloud situation observed during the flight:

West of Svalbard, shallow clouds evolved from the Longyearbyen fjord. Broken clouds and sometimes closed cloud layers were probed with the P6 over extended times between 700ft up to 4500ft. In the northern part, shallow convective cloud tops extended slightly above 4500 ft out of the cloud layer with a cloud top at ~4000 ft. At times precipitation and snow was encountered by the P6. At the below cloud legs at 600ft or 200ft, the open ocean was visible without ice cover.

Overview:

The original plan, a collocated flight together with Polar5 and HALO was postponed, due to a navigation instrument repair at P6 and some problems with P5. Therefore, the takeoff was delayed by both aircraft, an P6 took at 11:28 UTC after repair of the navigation instrument. P5 took off a bit later and this still enabled simultaneous measurements with P5, P6 and HALO.

After take-off at 11:28 UTC, ascent to FL5000 and the transfer to WP2 above clouds. A slow descent was performed through the clouds from WP1 to WP2 followed by a flight leg below clouds and a slow ascent into the clouds. HALO performed an overpass between flight leg 2 and 3 when the P5 was probing within the clouds. Clouds were probed at 1000, 2000, 3000 ft and the cloud top ranged near 4000 ft with some convective cloud tops extending to 4500 ft. At 12:59 UTC, between WP 3 and 4, the 230 V Inverter broke down and lead to the failure of the connected instruments onboard. As the cloud probes, the CVI and the trace gases were operating on 28 V, we took the decision to continue the flight with the reduced instrumentation. HALO was met a second time. Two good staged profiles through the clouds (closed or broken cloud decks) were performed with delta altitudes of 200 ft, 3 min legs, during descend and delta altitude 500 ft, 3 min during ascent at altitudes between 800 and 4000 ft. The P5 took of later cached up and performed coordinated measurement above P6 between WP 6-7

and WP 8-9, with the P6 often probing clouds. Between WP10, 11, 12 a below cloud leg was performed to collect sea spray INPs at 200ft above the open ocean. Then a climb to 14000 feet (with oxygen) and a 5 min flight leg at 14000 feet was performed for the trace gases, when also an enhance INP or aerosol layer was observed. Finally, P6 performed a slow descent profile from 14000 ft to LYB at a descent rate of 500ft /min.

Instrument Status:

Polar 6	
Basis data acquisition	
Nose Boom	
CVI	
ALABAMA	
Trace gas	
Aerosol	
HERA	
Polar nephelometer	
2D-S	
CCP	
PIP	
BCPD	

Table S5.1: Instrument status as reported after the flight for all instruments on Polar 6.

Comments: Due to the 230 V inverter break down 1,5h after take-off at 12:29 UT, some instruments lost connection and data and therefore are marked in yellow, instruments with a complete data loss are indicated in red. The trace gas instruments recorded GPS and flight trac data throughout the flight, which will help for data evaluation. GPS position data were also recorded by P6.

Foto Flight Logs (Time in UTC):

Note: Flight has been delayed by 2,5 h due to the repair of the navigation system.

11:58 crossing some clouds right after T.O.



12:43



13:59



13:59



14:01

14:02



14:26



15:03



15:03

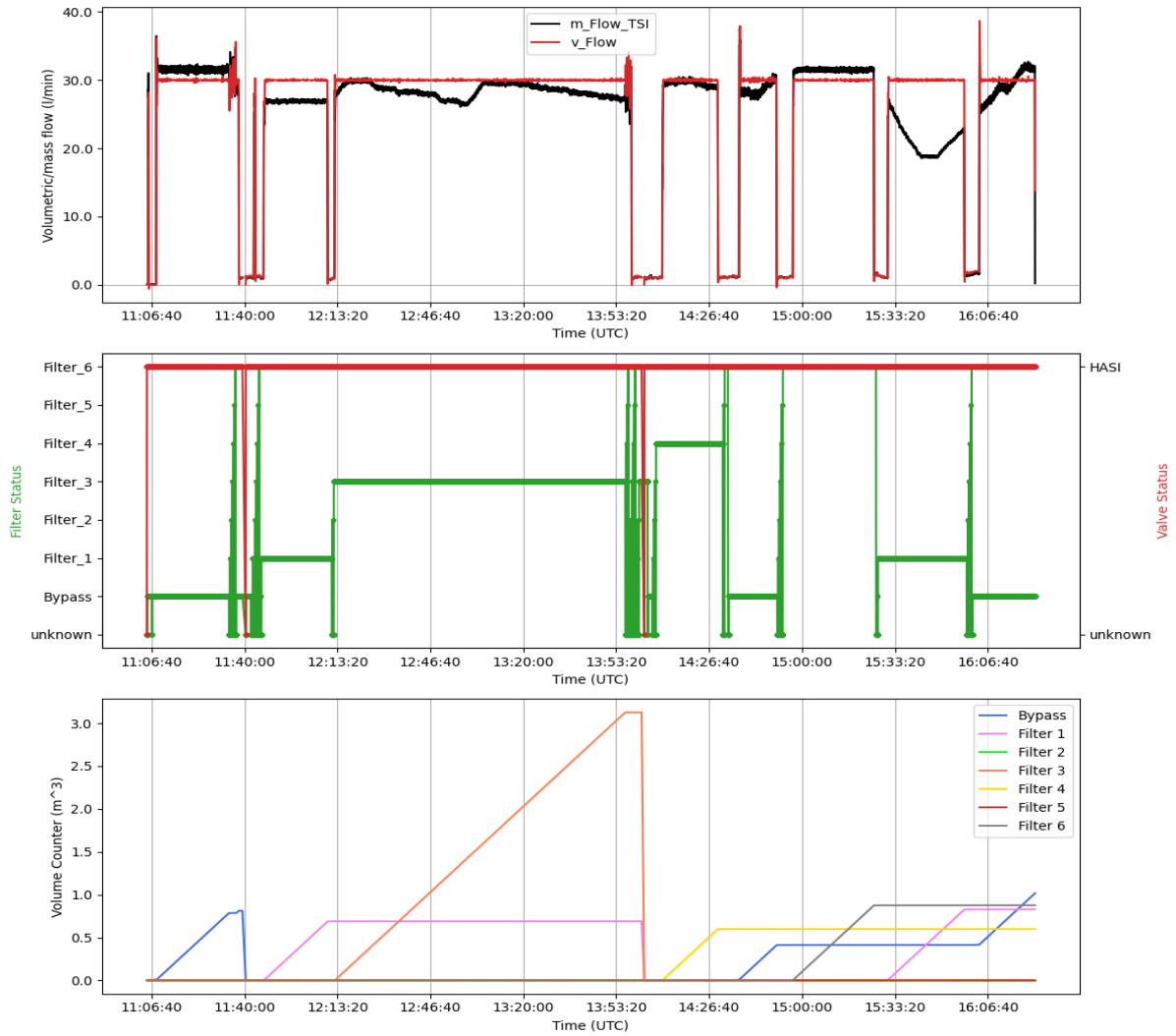


15:07

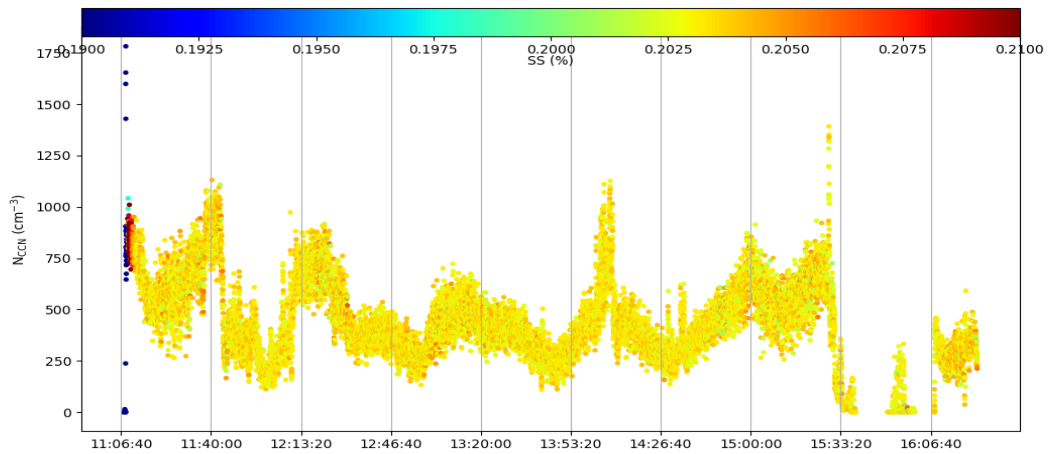


Quicklooks:

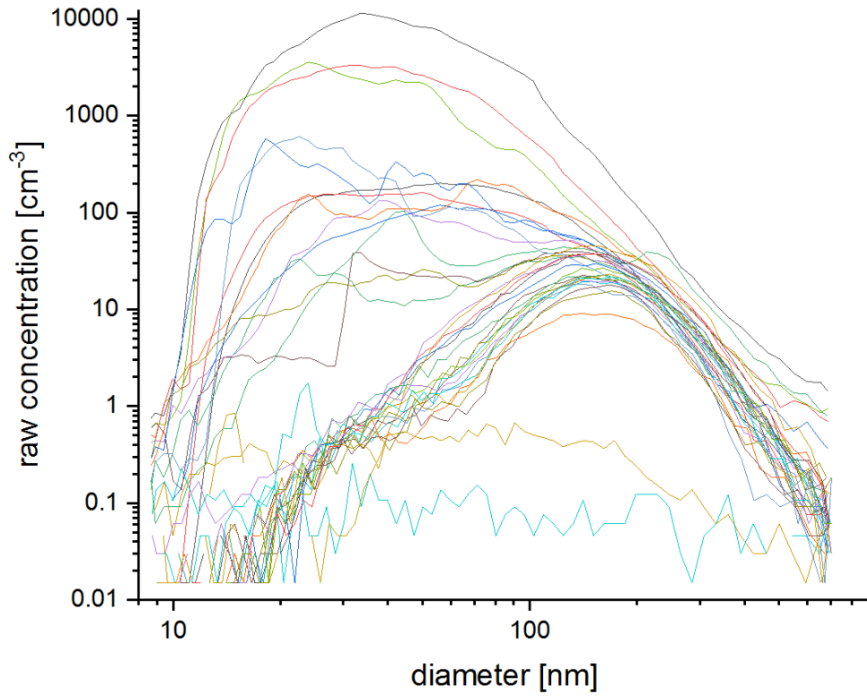
HERA



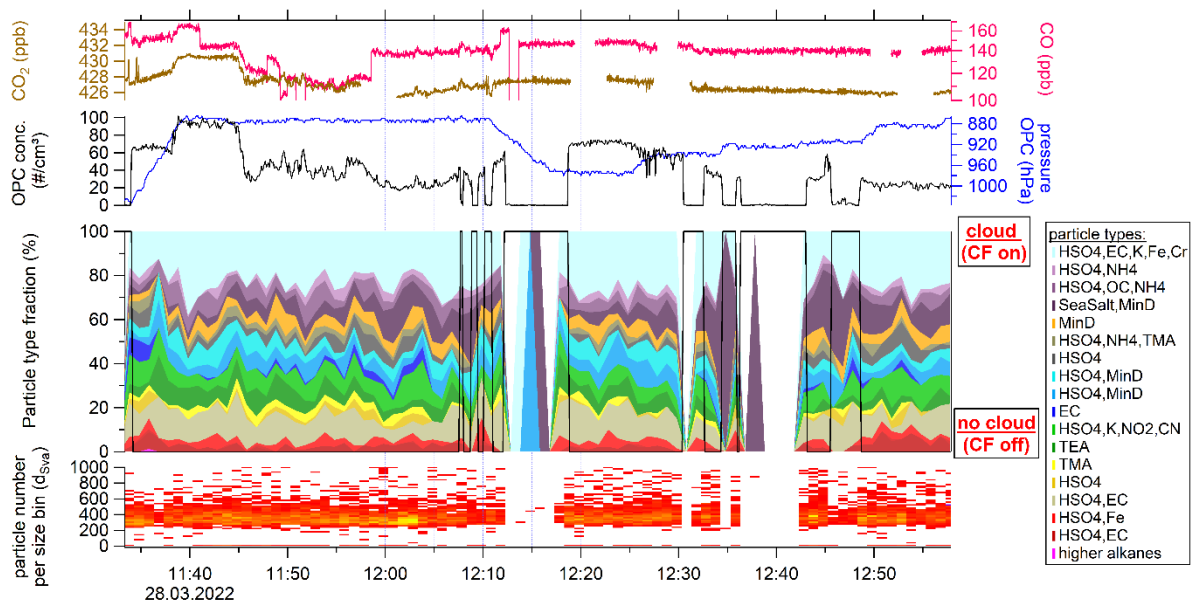
mCCNC



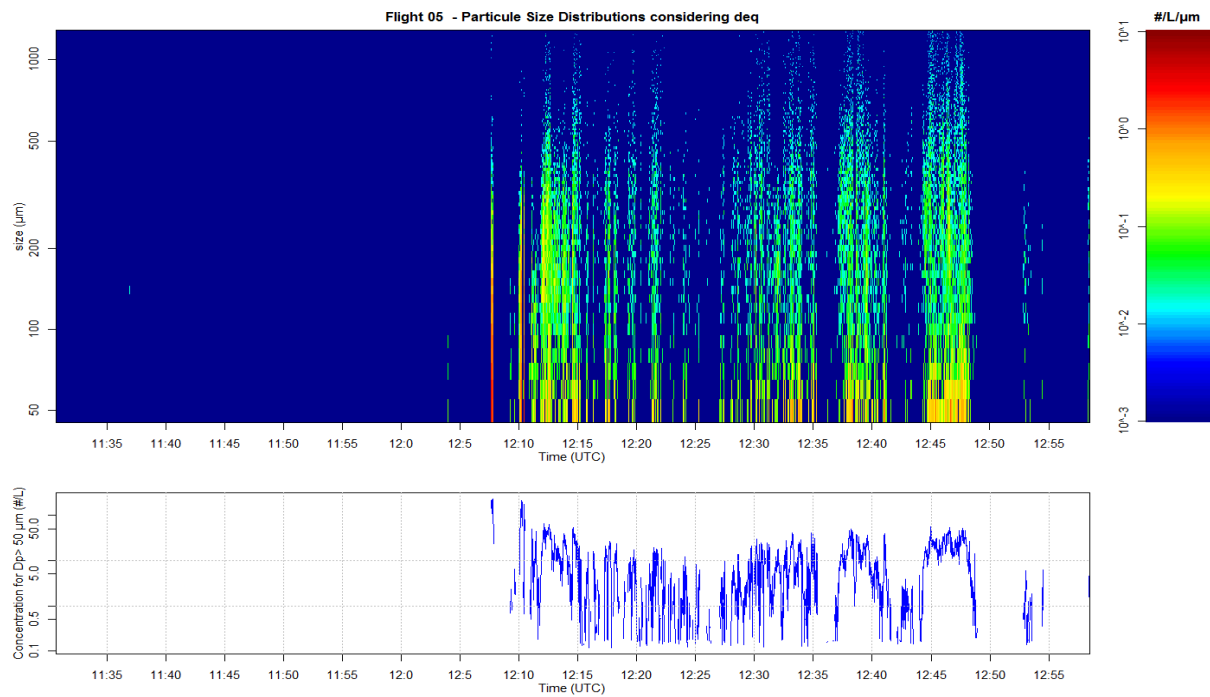
SMPS



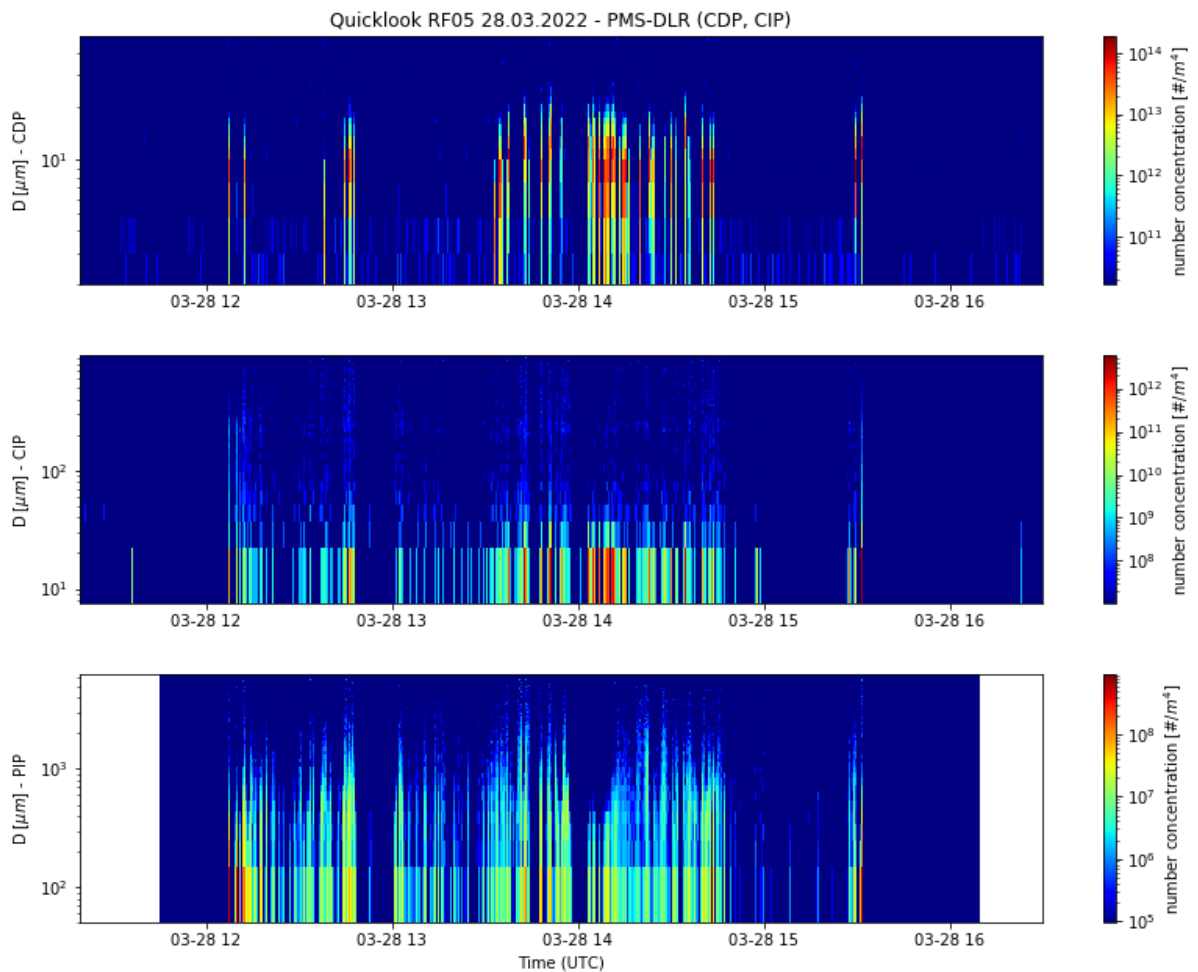
ALABAMA



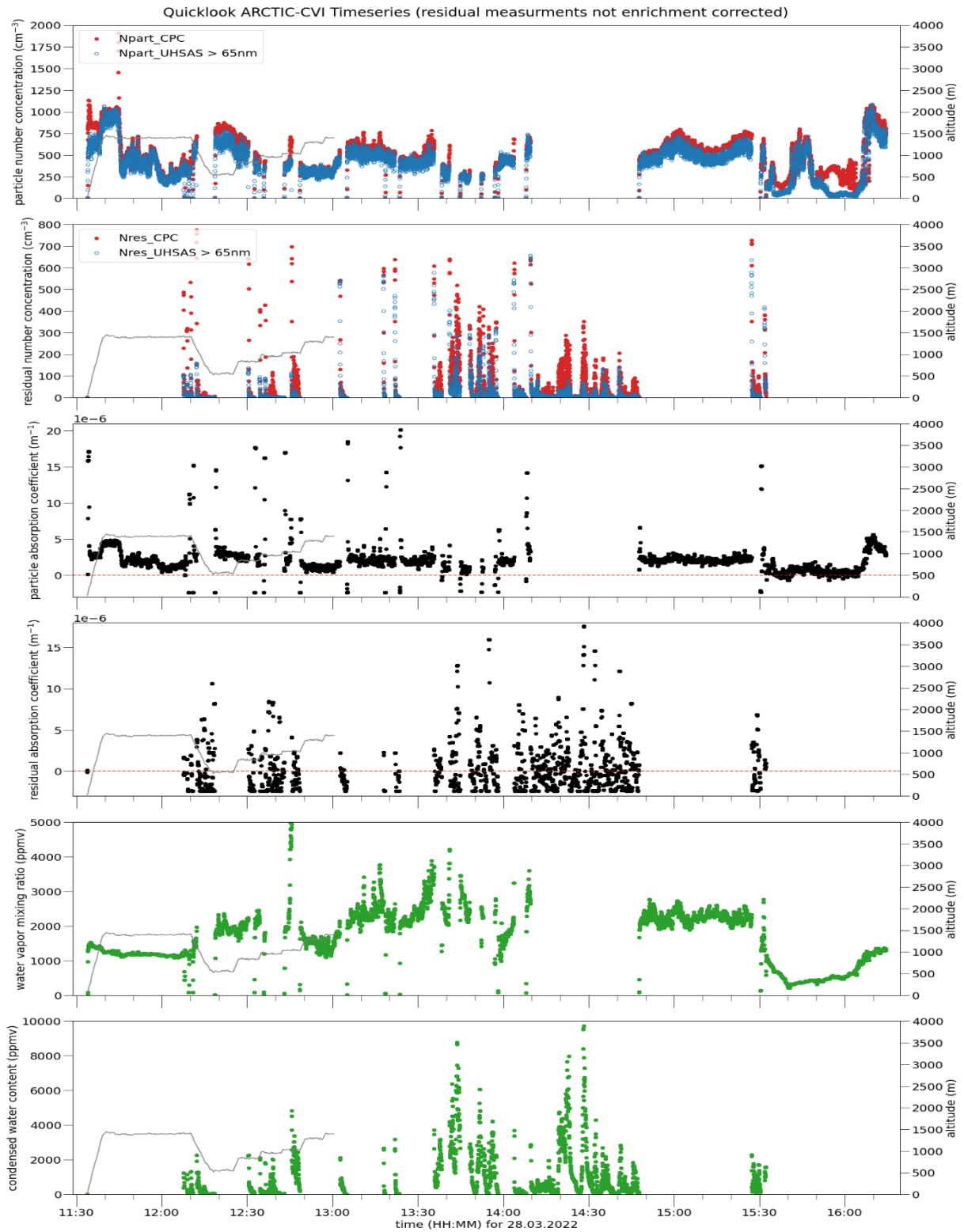
PMS-LaMP



PMS - DLR



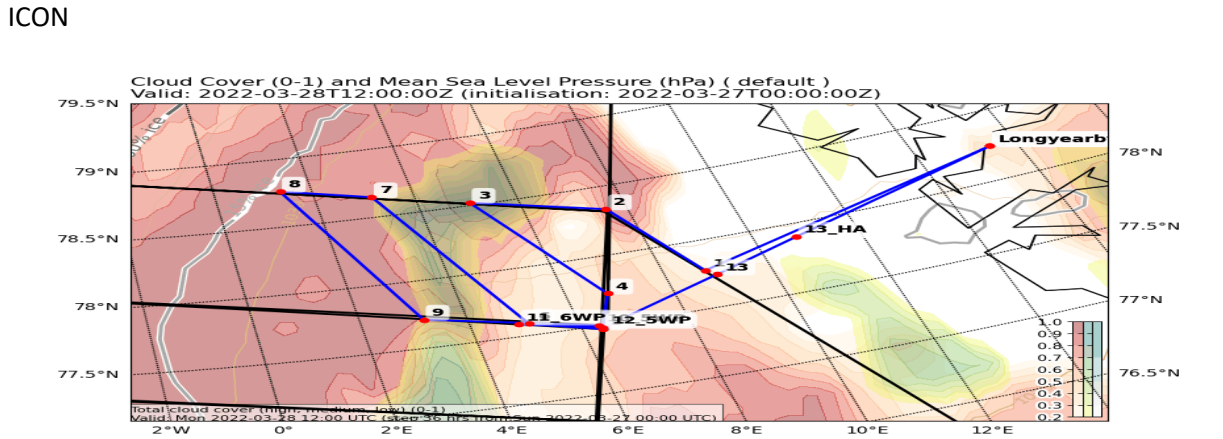
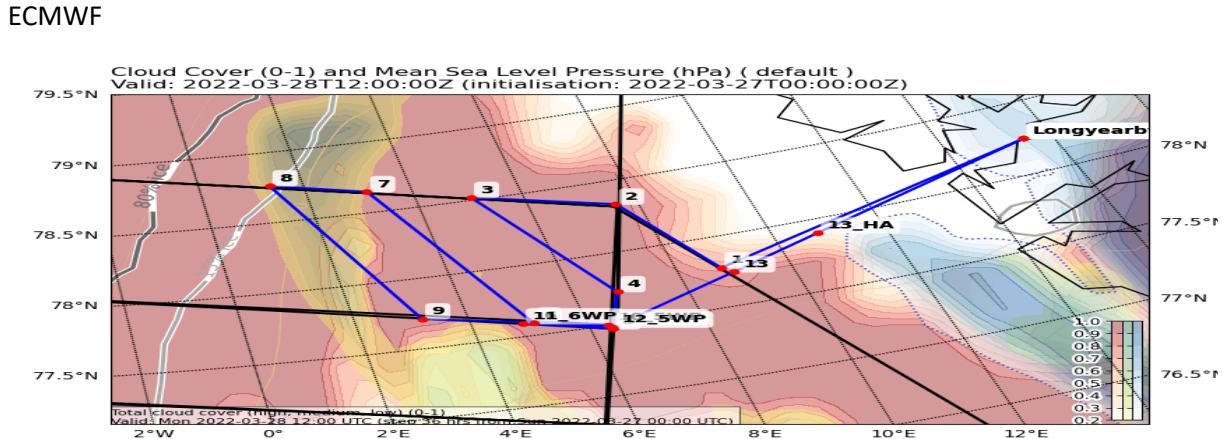
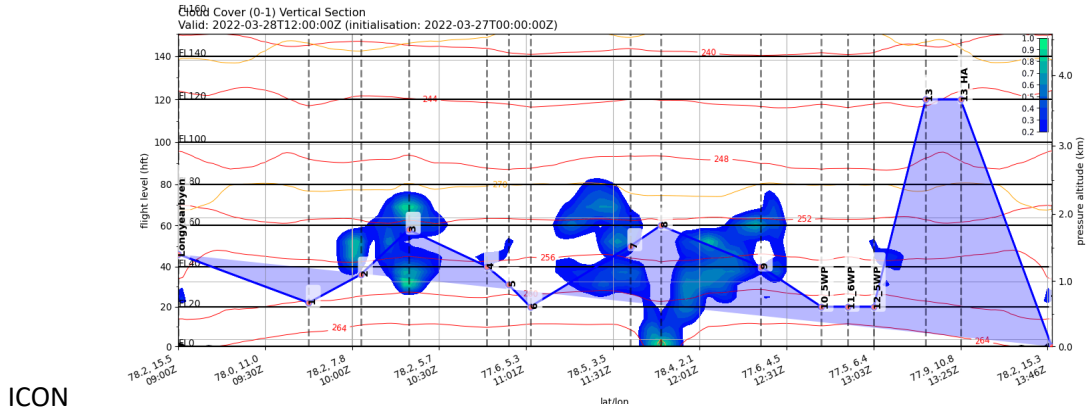
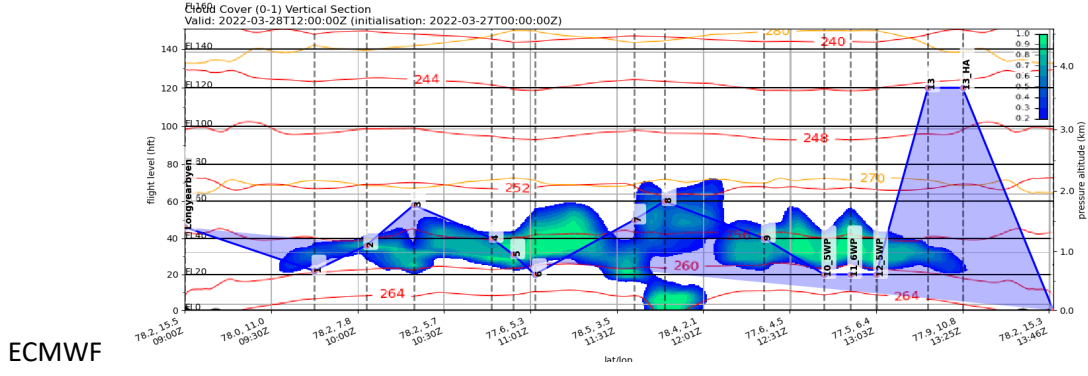
CVI



Additional flight planning information

Flight plan

LYR – W1 ascent to FL 50: 1000ft/min, 5 min FL50 then descent to FL20	44 min
W1 ↔ W7 staggered patterns, 7 min each (120kn, 500ft/min)	
1 leg below cloud, 2-3 legs in cloud (e.g. FL 30, 40, 50) one leg above cloud (e.g. FL60), slow descent through clouds, then restart, all turns short turns	1h32 min
W7 ↔ W8 convergence zone FL50 in clouds	11 min
W8 ↔ W9 slow ascent through clouds, staggered patterns, 6 min legs (e.g. FL 40, 35, 30, 25, 20) in cloud and below cloud	33 min
W9 ↔ W10 slow descent through clouds, then descent to FL20 below clouds	22 min
W10 ↔ W12 below cloud legs, aerosol, turbulence: FL20, 120kn	20 min
W12 ↔ W13HA ascent through cloud to FL140, stay FL140, 140 kn for high latitude leg 500 ft/min in cloud, 1000 ft/min above cloud 140 kn	22min
W13HA ↔ LYR slow descent	21 min
Total:	4 hr 46 min



WINDY

