COMPEX-EC Flight RF04 – Polar 5 – 2025/04/08

Pilot	**Kyle McLenaghan**
1st Officer	**Bailey Pegels**

Mission PI	**Marcus Klingebiel**
Basis Data	**Dennis Ludwig**
SMART/ Eagle/Hawk	**Joshua Müller**
MiRAC-A / HATPRO	**Christian Buhren**
AMALi / Dropsondes	**Friedhelm Jansen**

Flight times:

Take off	**11:58 UTC**
Touch down	**15:58 UTC**

Objectives:

- **Match the EarthCARE satellite track over the Gulf of Bothnia.**
- **Measure cloud layers along the coast of Norway**
- **Observe the temporal development of clouds along the satellite track by sampling the track twice.**

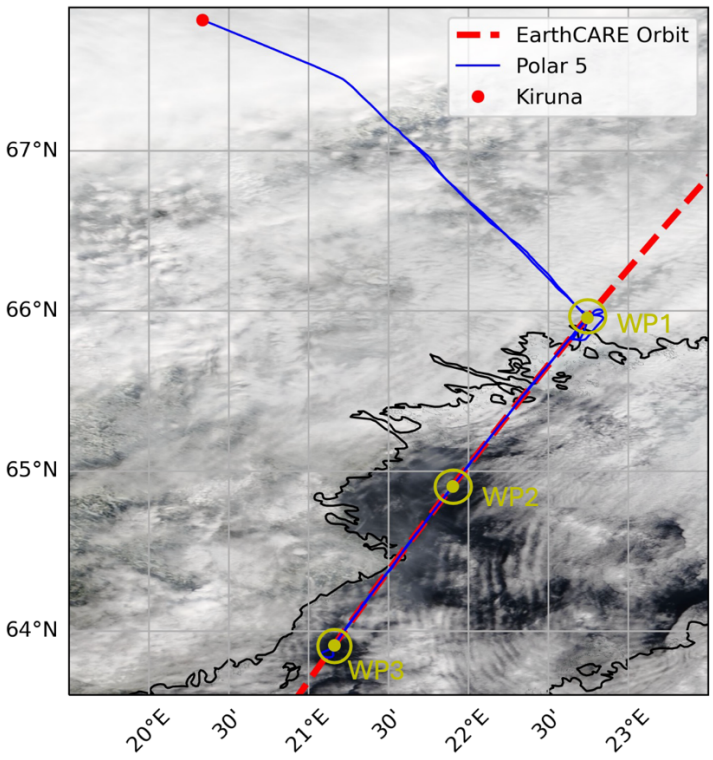

Figure 1: Flight and satellite track over MODIS RGB composite satellite image for RF04 on 08.04.2025.

Weather situation as observed during the flight (compare to forecast):

On Tuesday 08.04.2025, a low pressure system between Svalbard and the northern Norwegian coast strengthened, which led to an increase in wind. With the arrival of the low pressure system, higher clouds (>3000m) were observed, which were also correctly predicted by the models. This led to the decision to fly at an altitude of 5000m in order to be able to measure above the clouds. As correctly predicted by the models, the clouds over the Bothnian Sea were optically thinner with partly clear-sky conditions.

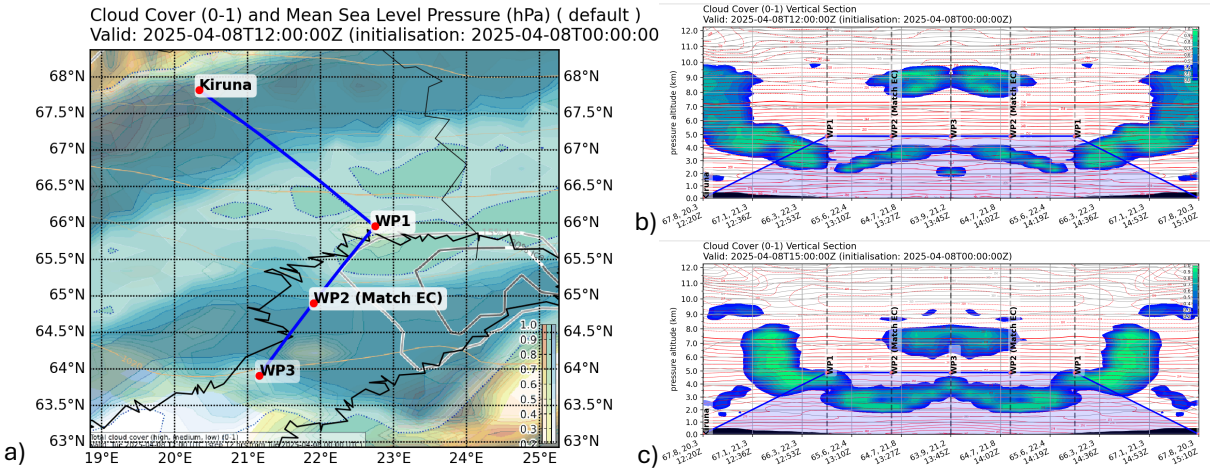

Figure 2: Forecasted cloud conditions from ECMWF in the area of the planned flight track (a). Vertical cross sections of the ECMWF cloud forecast along the flight track for 12:00 UTC (b) and 15:00 UTC (c).

In Fig. 3 the actual cloud situation during the flight is shown. As mentioned before, the different cloud layers are visible. Clouds above the airplane where mostly visible, with some cloud free sections (Fig. 3d). The clouds below the aircraft reached higher altitudes, so that the Polar 5 had to stay in an altitude about 5 km. The clouds had some layered structures, which are visible nicely in the radar reflectivity.

Figure 3: Photos taken during RF04 to the left side of the plane (a,b,c,e) and to the right side (d,f).

Mission Summary:

The mission went very smoothly overall and stayed well on schedule. From engine start to taxiing to the runway, the entire ground procedure took about 20 minutes. The main issue we encountered was with the lower Albedometer, which failed to move downwards after engine start. We considered shutting down the engines to resolve the issue, but doing so would have meant missing the satellite overpass. In the end, we chose to proceed with the flight without the lower Albedometer. This decision proved to be the right one—cloud conditions were not ideal for Albedometer measurements, and the repair would have taken longer than anticipated.

Polar 5 took off at 11:58 UTC, two minutes ahead of schedule. On the way to WP1, we encountered thick cloud layers that required us to climb to approximately 5000 m altitude. At this height, we maintained sufficient distance from the cloud tops to enable quality radar measurements while still remaining low enough for ground signal detection. We arrived at WP1 about 20 minutes early, as planned, to provide a buffer in case of any delays or technical issues. To stay on schedule with the satellite overpass, we flew a holding pattern along the flight track at WP1. After this, we continued along the EarthCARE satellite track and successfully matched the satellite at WP2 at 13:30 UTC. We then continued along the satellite leg to WP3, where we turned around and retraced the same path back to WP1 to capture temporal changes in cloud structure.

Unfortunately, we were not granted permission by ATC to deploy dropsondes along the flight track. Although the pilots continued to request clearance, our applications were consistently denied. After this flight we get in touch with the Swedish ATC to hopefully get the permission for launching dropsondes over Sweden for the next research flights.

Instrument Status:

Polar 5	
Basis data acquisition	
MiRAC-A	
HATPRO	
AMALi	
SMART	Lower Albedometer not operating
Eagle/Hawk	
Dropsondes	None launched

Table 1: Instrument status as reported after the flight for all instruments on Polar 5.

Comments:

- The Albedometer didn't move down after the engines were on. After the flight the AWI mechanics figured out that a cable was broken.
- The radar didn't measure for 14 minutes during the flight, but the operator could tackle the issue.
- Even we planned a flight over water, we didn't get permission from Swedish ATC to launch dropsondes during the flight.

Detailed flight logs:

11:32 UTC	**Engines on**
11:40 UTC	**Lower Albedometer is not moving down at the bottom of the fuselage**
11:53 UTC	**Rolling to runway**
11:58 UTC	**Take off**
12:02 UTC	**Getting up, opening roller doors**
12:15 UTC	**Climbing up higher to get over the clouds -> Oxygen needed**
12:33 UTC	**15300 ft -> up to 16700 ft**
12:44 UTC	**Reaching WP1**
	Holding pattern (two rounds), Clouds match the forecast very well.
13:10 UTC	**Clouds above and below Polar 5. Two layers below.**
13:30:24 UTC	**WP2, EarthCARE match. Just 4 seconds later than planned! Wohoo!**
	Dropsondes unfortunately not possible for the whole flight. ATC denied our request
13:53 UTC	**WP3, turn around, broken clouds below us, just one layer**
14:14 UTC	**Radar does not work**
14:28 UTC	**Radar running again**
15:25 UTC	**Rolling doors closed**
15:58 UTC	**Touch down**

Quicklooks:

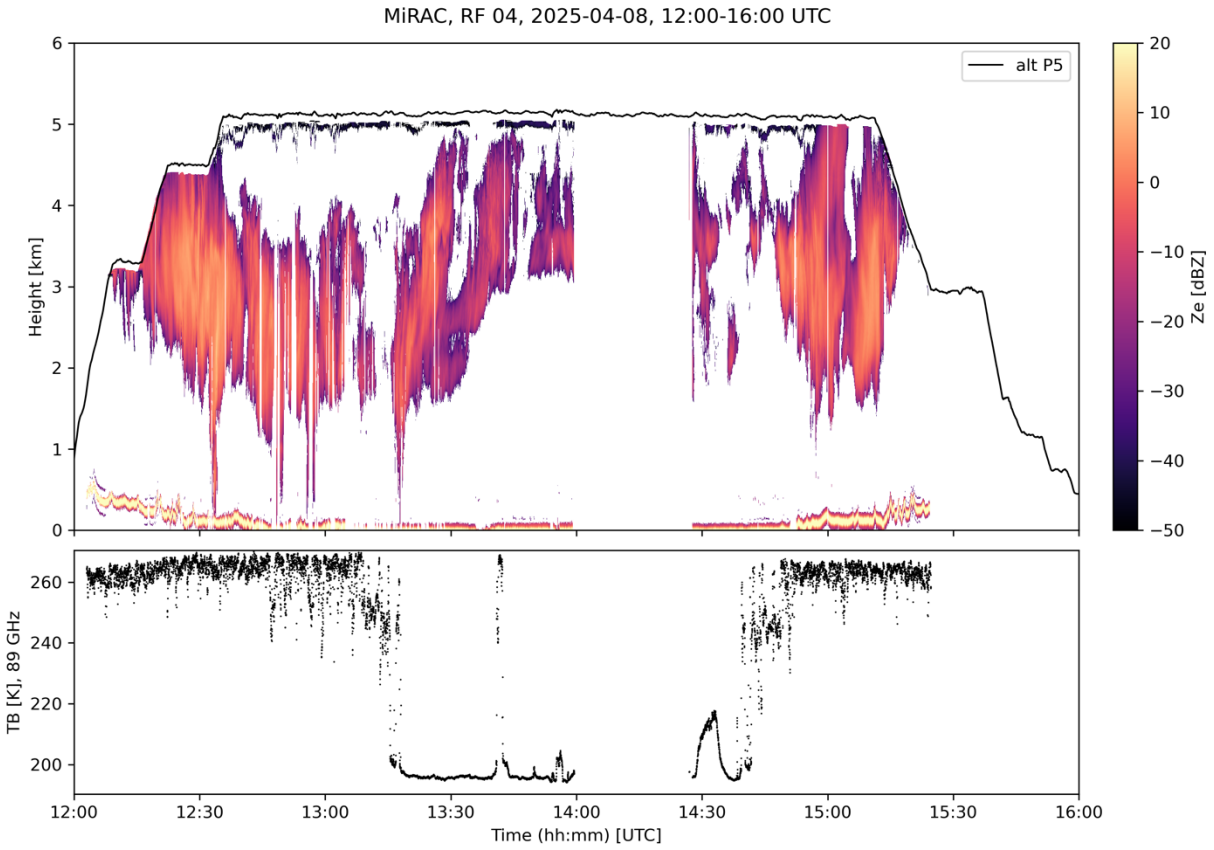

Figure 4: MiRAC radar (upper panel) and 89 GHz brightness temperature (lower panel).

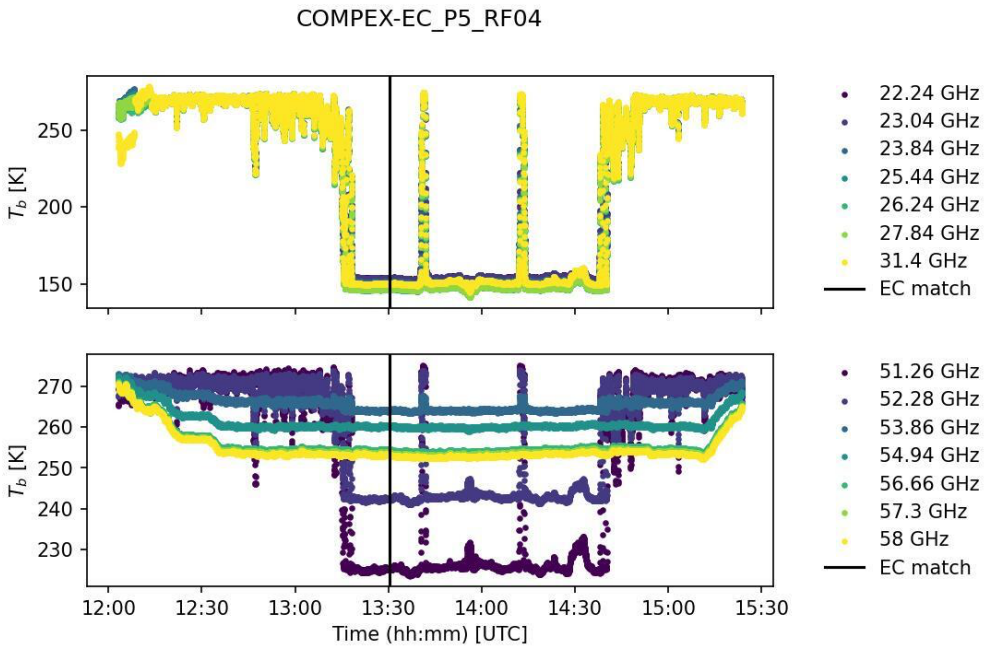

Figure 5: HATPRO brightness temperatures for different channels along the whole flight.

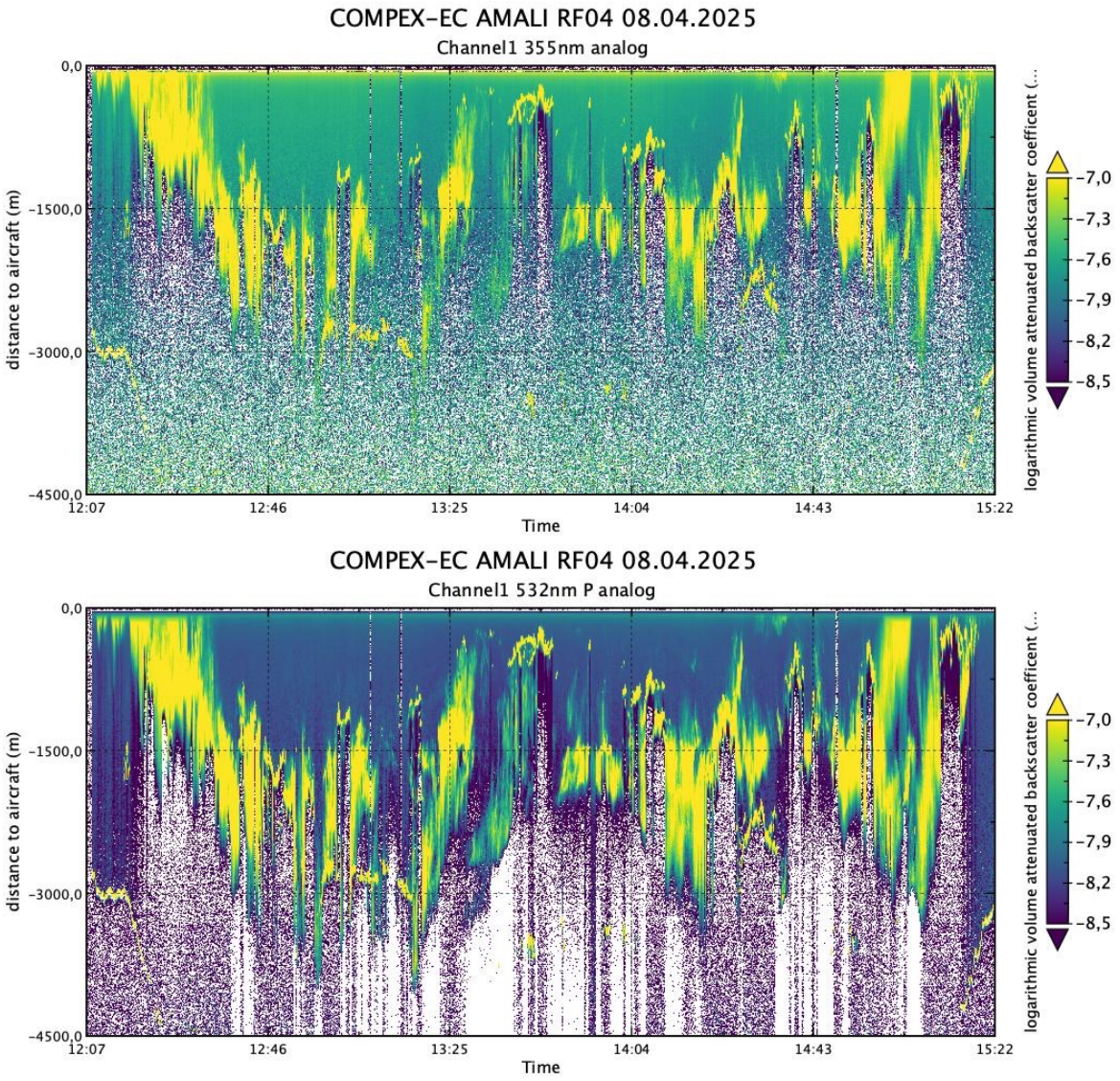

Figure 6: AMALi Lidar quicklooks. Upper panel for 355 nm and lower panel for 532 nm.

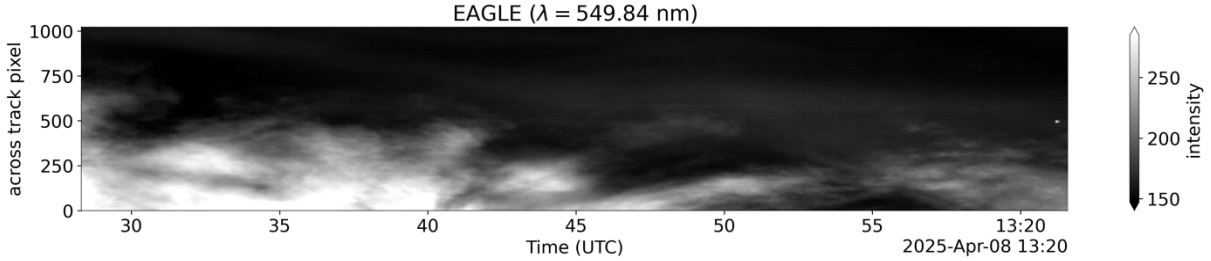

Figure 7: Sample image of the EAGLE spectral imager instrument.

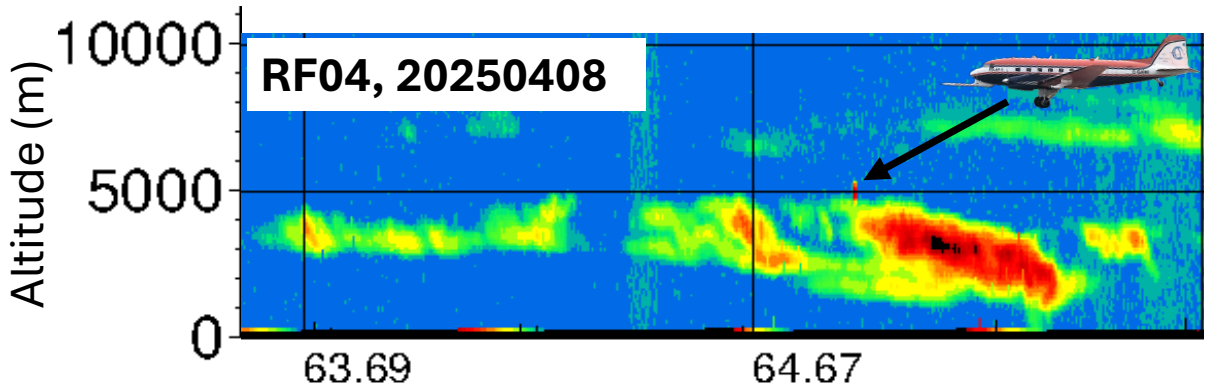

Figure 8: Quicklook from the EarthCARE radar. The Polar 5 is visible as an echo in the EarthCARE radar data.