COMPEX-EC Flight RF02 – Polar 5 – 2025/04/06

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	**12:20 UTC**
Touch down	**16:21 UTC**

Objectives:

- **Evaluation of EarthCARE MSI instrument by flying parallel to the satellite track**
- **Passing over the Pallas research station**

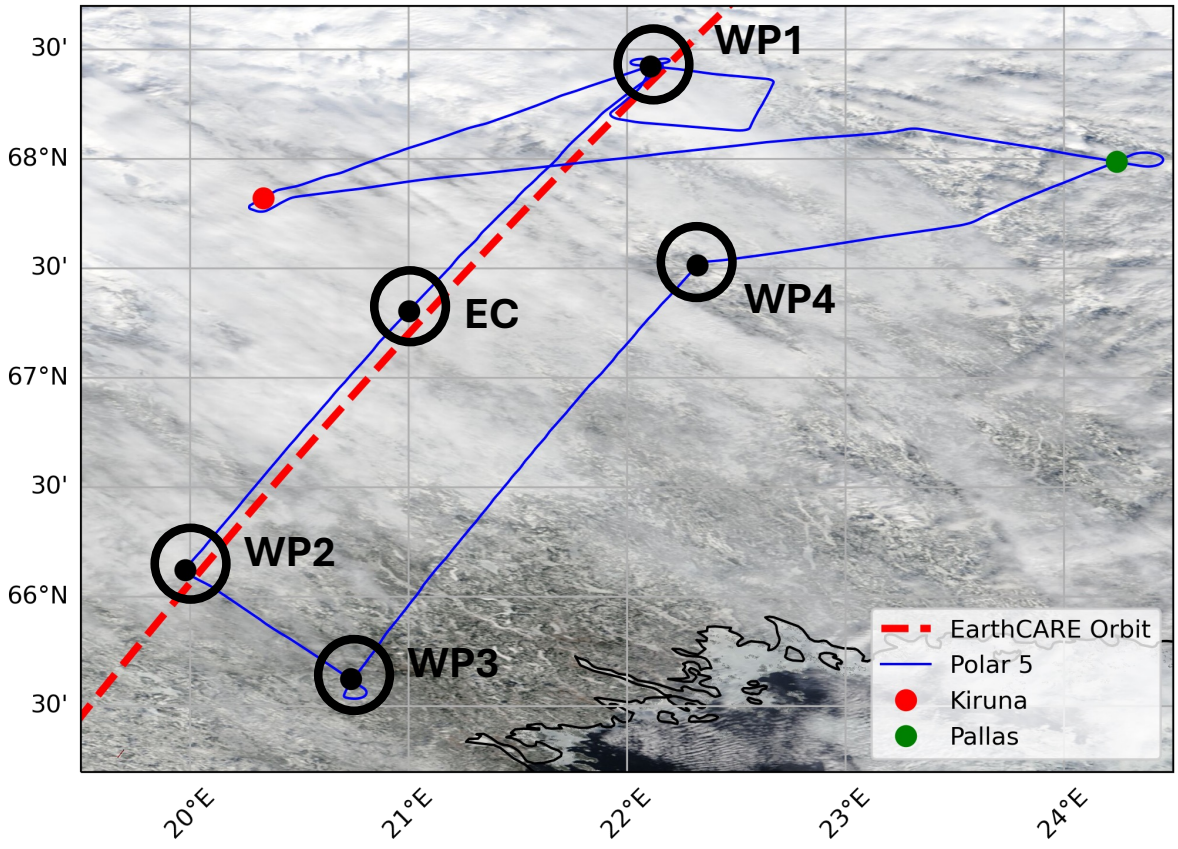

Figure 1: Flight and satellite track over MODIS RGB composite satellite image for RF02 on 06.04.2025.

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

The weather situation on Sunday, April 6, 2025, was mainly forecasted correctly by the models (ICON, ECMWF). There was a predominantly north-easterly air mass flow with moderate winds at FL110 (3000m). Low clouds were calculated along the flight route (see Fig. 2), but these dissipated from the match point with EarthCARE, so that clear conditions prevailed at WP2. As the flight progressed, more and more clouds were observed, up to a closed cloud cover around Pallas, Finland, which was not predicted by the models.
According to the model calculations, hardly any clouds should be visible around Pallas. Overall, the cloud height was correctly predicted at 2000 m, with the exception of the section around Pallas. Here the clouds were denser and were observed at an altitude of 2500 m, which is why we increased our flight altitude by 200 m.

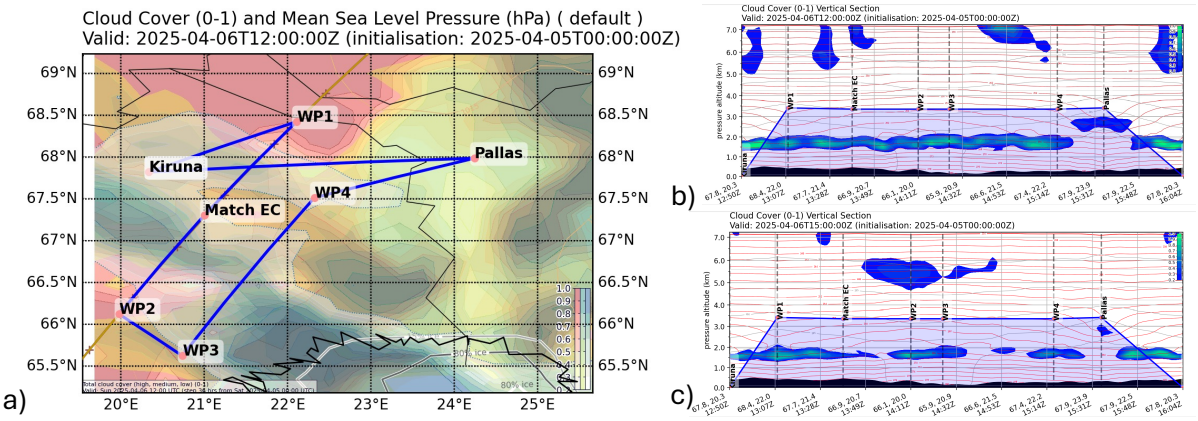

Figure 2: Forecasted cloud conditions from ECMWF in the area of the planned flight track (a). Vertical cross sections of the ECMWF cloud forecast along the flight track for 12:00 UTC (b) and 15:00 UTC (c).

In Fig. 3 the actual cloud situation during the flight is shown. As mentioned before, the forecast was mostly right between WP1 and WP2. On the way to Pallas, the clouds were thicker than we expected.

Figure 3: Photos taken during RF02 to the right side of the plane (a,b,f) and to the left side (c, d, e).

Mission Summary:

Initially, the mission was planned as an underflight of the EarthCARE satellite between WP1 and WP2. However, a misalignment between the Polar 5 flight path and the EarthCARE orbit (32 km off) led to an unexpected, yet beneficial, outcome: two parallel flight legs, ideal for comparing MSI data with our spectral imaging instruments, namely EAGLE and HAWK.

The beginning of the flight went very smoothly. We left ten minutes early so that there was enough time for an optional radiation square (important for Albedometer calibration) at WP1. Unfortunately, we didn't get the permission from the Swedish ATC to launch dropsondes during the whole flight. As we flew parallel along the EarthCARE orbit, we identified thinner clouds over snow. The clouds got thicker on the way back to WP4. For this reason we decided to pass over Pallas. There, the cloud layer was dense and thick, and not like expected from the forecast.

All in all, it was a successful flight, with a slight adjustment to the mission goals afterward. The collaboration with the crew and pilots worked very well.

Instrument Status:

Polar 5	
Basis data acquisition	GPS 5 did not work. No problem for us though ☺
MiRAC-A	
HATPRO	
AMALi	
SMART	
Eagle/Hawk	
Dropsondes	None launched

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

Comments:

- GPS 5 did not operate during the flight. The operator assumed a broken antenna. It didn't affect the measurements though, because no instrument relies on it.
- Unfortunately, we didn't get permission from Swedish ATC to launch dropsondes during the whole flight.

Detailed flight logs:

11:45 UTC	**Boarding the Polar 5**
12:15 UTC	**Start rolling to the runway**
12:20 UTC	**Take off**
12:30 UTC	**Reaching Flight Level 110**
12:45 UTC	**Approaching WP1 and starting radiation square (5 minutes on each leg)**
13:20 UTC	**Swedish ATC does not give the permission to launch dropsondes. The pilots requested it several times for different locations, but it wasn't possible. On the EarthCARE leg we see thin clouds over snow. Patchy clouds.**
13:40 UTC	**EarthCARE is flying by, still patchy clouds**
13:50 UTC	**Transition to clear sky**
14:15 UTC	**Just a few clouds in the vicinity**
14:52 UTC	**Approaching cloud field**
15:02 UTC	**GPS 5 no signal**
15:27 UTC	**Precipitation below clouds**
15:32 UTC	**Approaching Finnish boarder. Because we can cross boarders only at specific points, we need more time than expected.**
15:41 UTC	**Approaching Pallas, after two overflights we turn around and heading back to Kiruna**
16:21 UTC	**Touch down**

Group-Picture of the crew: Joshua Müller, Christian Buhren, Marcus Klingebiel, Friedhelm Jansen, Bailey Pegels and Kyle McLenaghan

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Quicklooks:

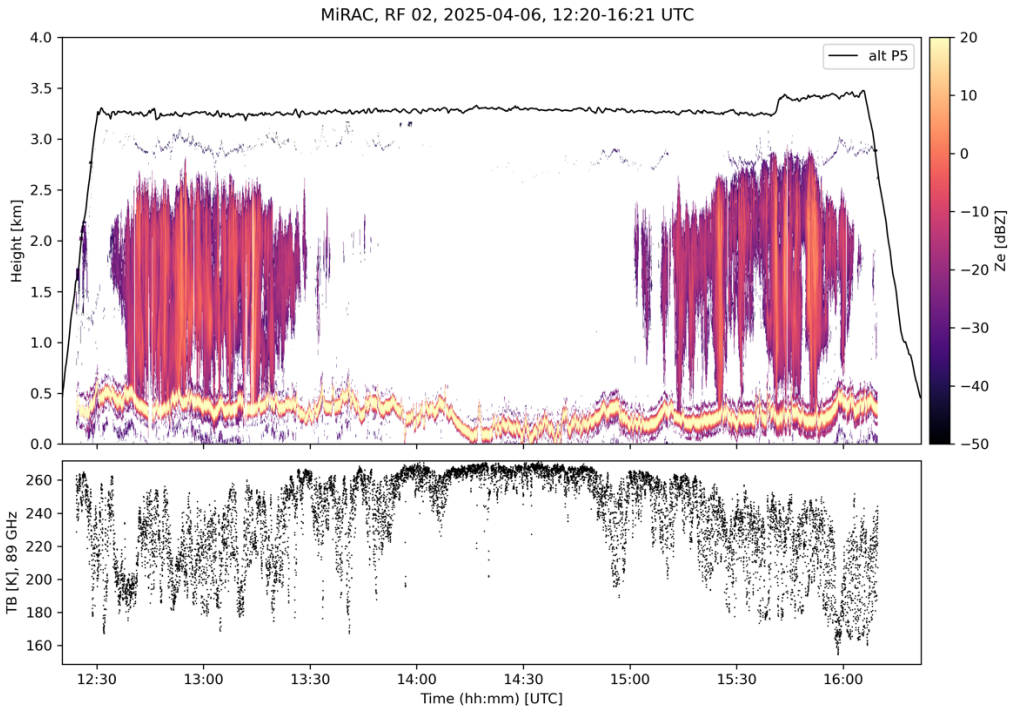

Figure 4: MiRAC radar (upper panel) and 89 GHz brightness temperature (lower panel).

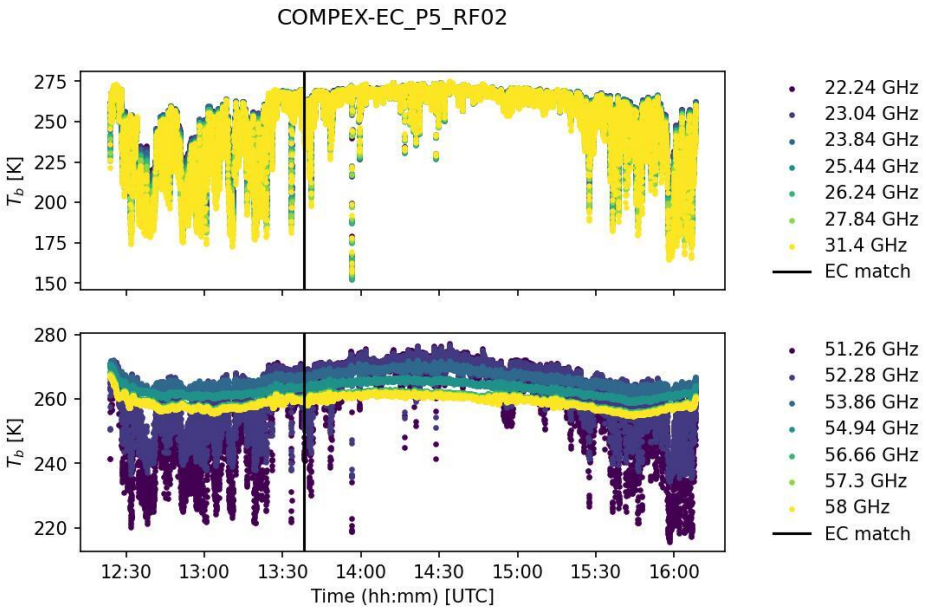

Figure 5: HATPRO brightness temperatures for different channels along the whole flight.

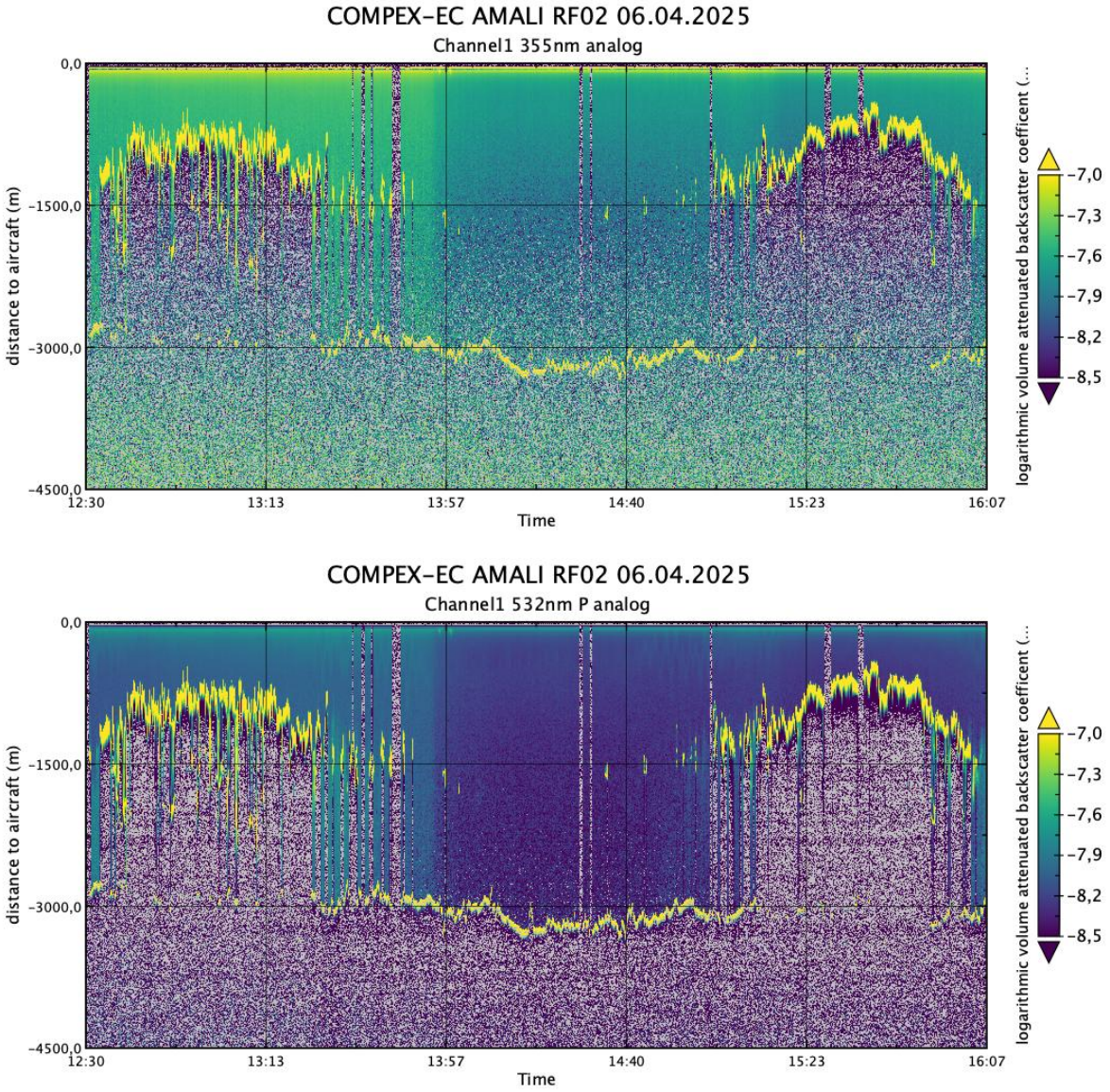

Figure 6: AMALi Lidar quicklooks. Upper panel for 355 nm and lower panel for 532 nm.

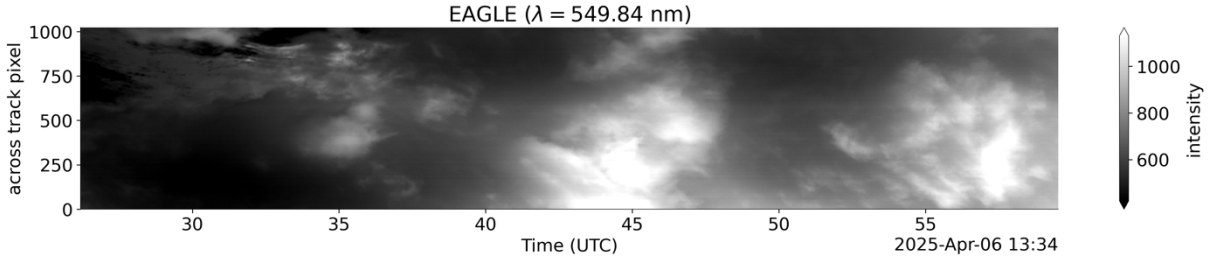

Figure 7: Sample image of Eagle spectral imager.

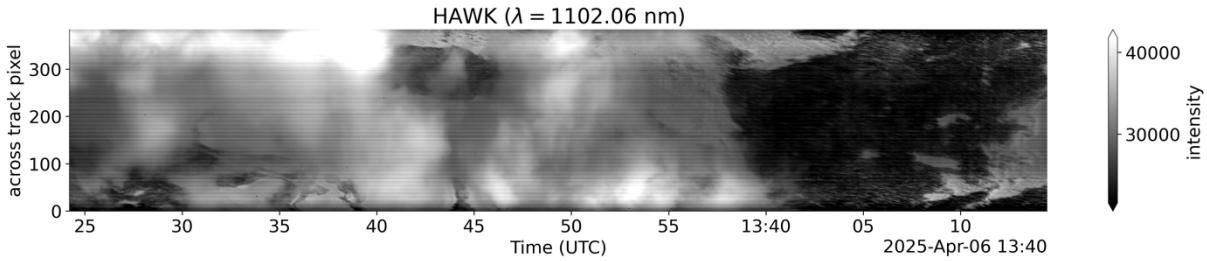

Figure 8: Sample image of HAWK spectral imager.

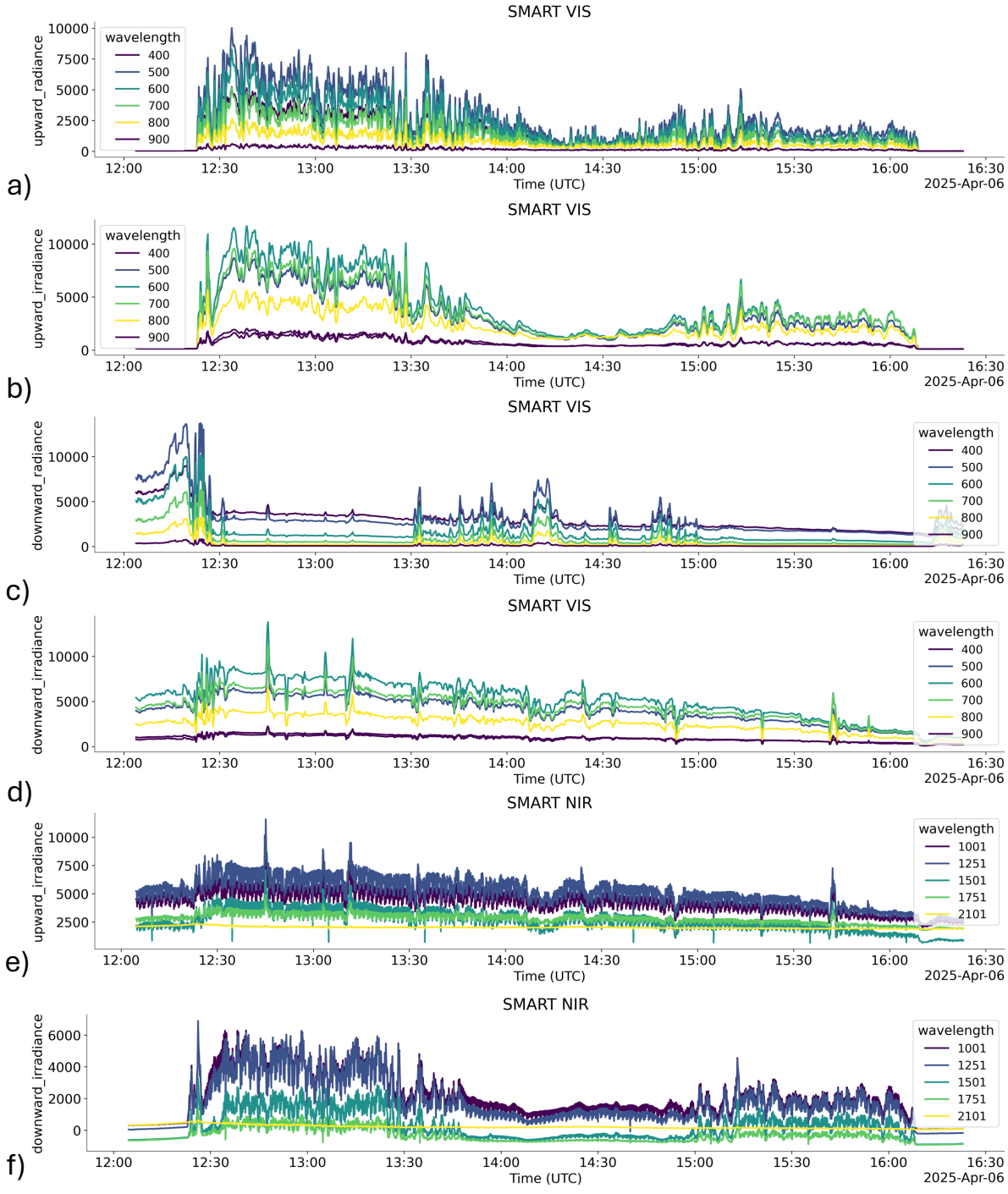

Figure 9: SMART radiance and irradiance measurements in downward and upward direction.

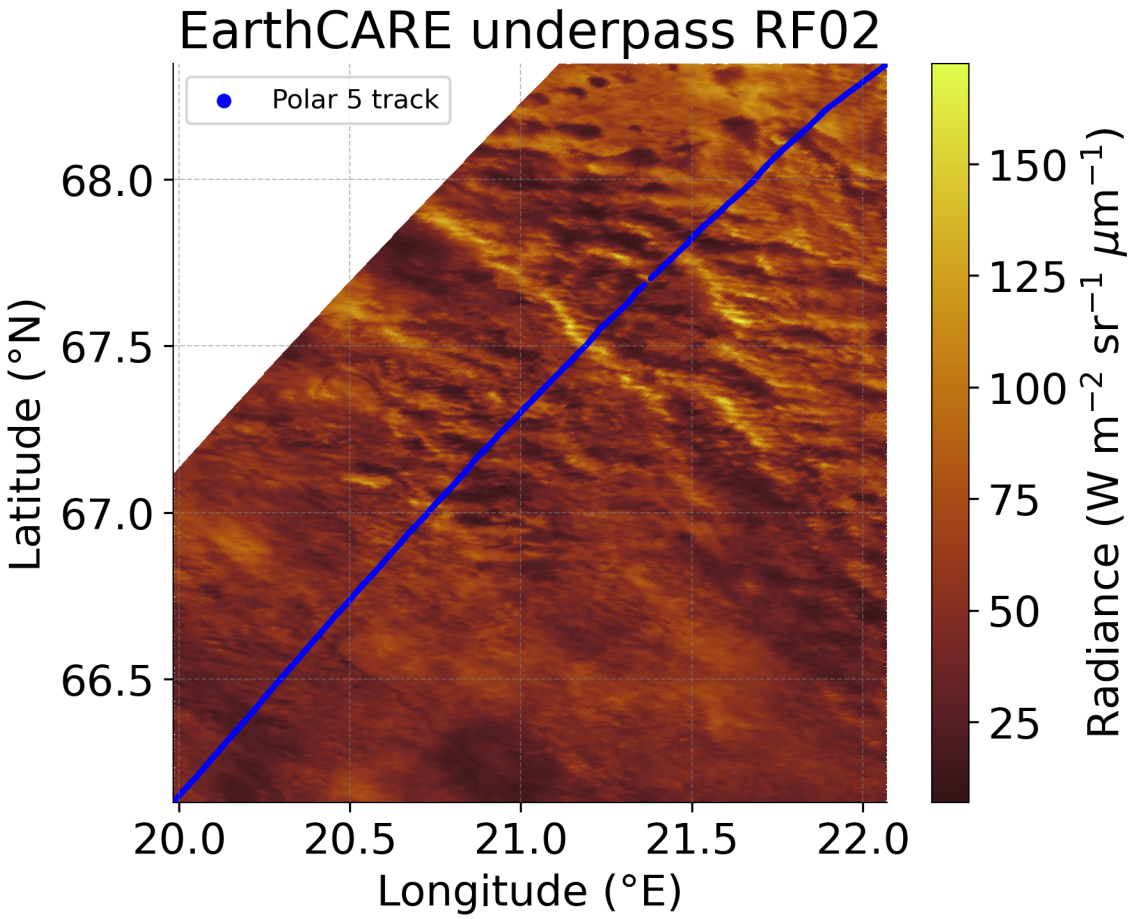

Figure 10: EarthCARE MSI data with Polar 5 flight track.