

ACLOUD Flight #20 – Polar 5 – 170618

Mission PI: Manfred Wendisch

Objectives: The objectives were the same as on the previous flight #19, but this time there was no mid-level cloud (no contamination by synoptic system). We aimed to measure cloud properties by in situ and remote sensing techniques above sea ice, in the transition zone between sea ice and open water and over sea. We had mostly one layer of low-level cloud, which we succeeded to observe from above. Above the aircraft there was no cirrus during almost all of the flight. The cloud layer was different over sea ice and open water: more homogeneous over sea ice, more turbulent over open water. These clouds were not contaminated by synoptic systems, they were mostly driven by local surface properties (sea ice, open water).

Crew:

Polar 5	
PI	Manfred Wendisch
Basis Data Acq.	Lukas Kandora
SMART	Elena Ruiz
Eagle/Hawk	Tobias Donth
Mirac	Tobias Doktorowski
Amali	Marek Jacob

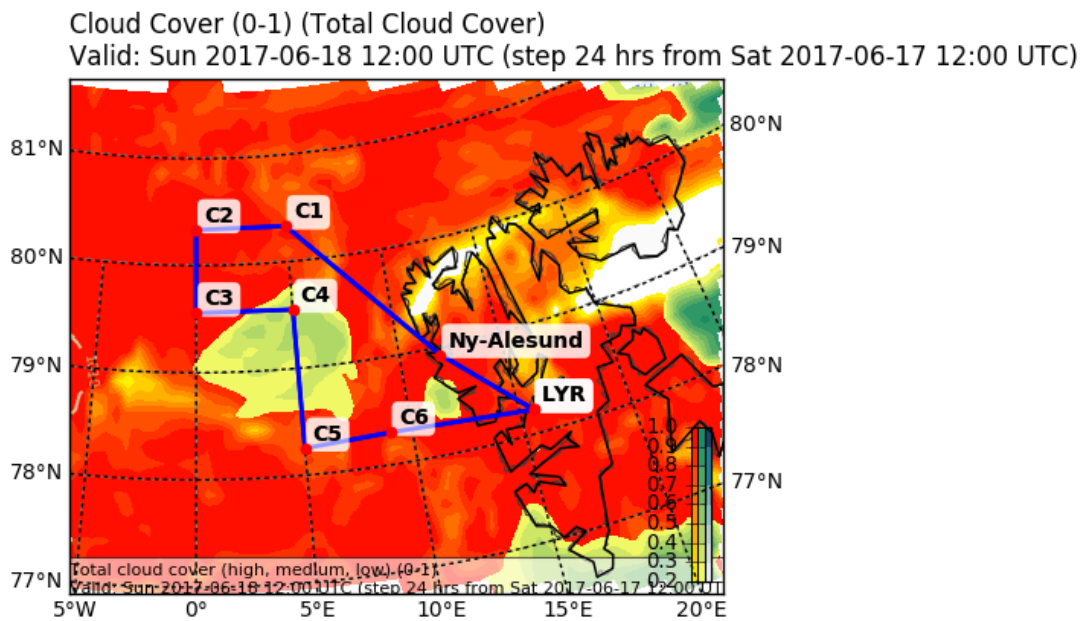
Flight times:

Polar 5	
Take off	12:04 UTC
Touch down	17:44 UTC

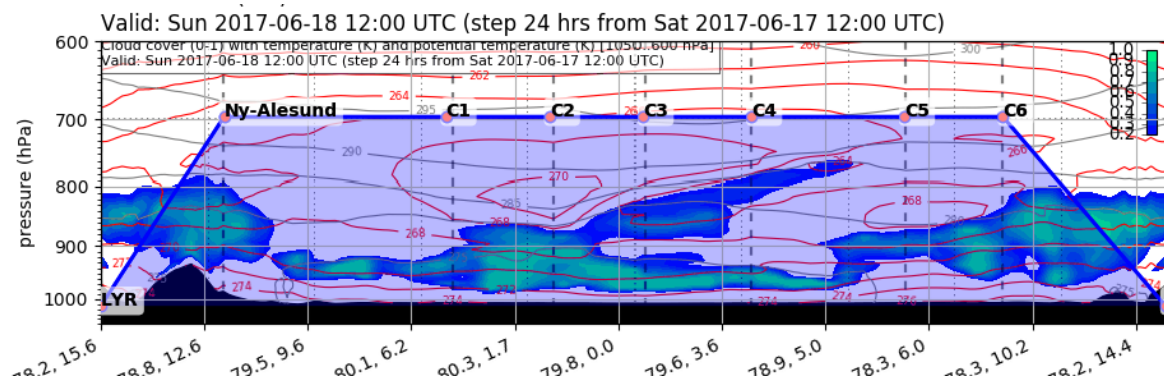
Weather situation as observed during the flight (compare to forecast)

We had a coordinated flight with both aircraft, P5 and P6. The purpose was to investigate cloud properties developing over sea ice, and to follow their transition to the open sea. The cloud situation was such that there was one extended cloud layer. We flew above the observed **low-level** clouds with P5 (mostly at 10,000 ft), while P6 sampled the clouds in situ and closely coordinated with P5. The flights went very well, and we collected promising data.

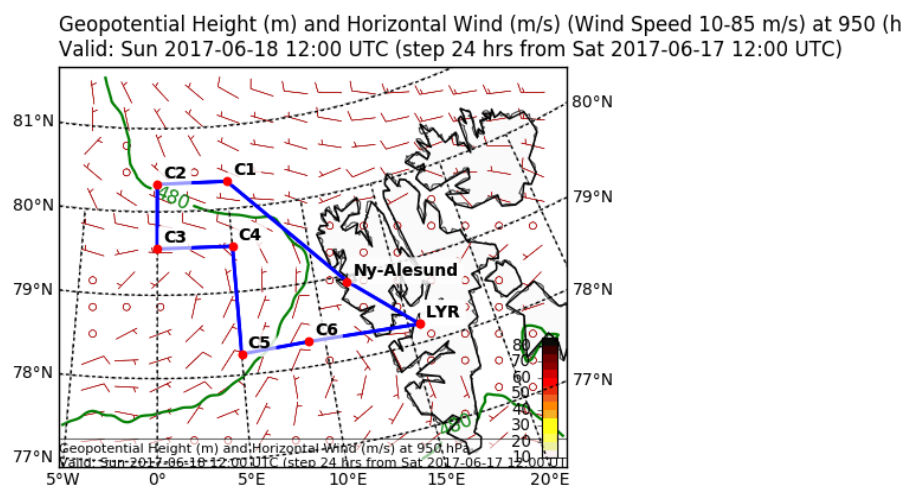
ECMW prediction of clouds—horizontal



ECMW prediction of clouds—vertical



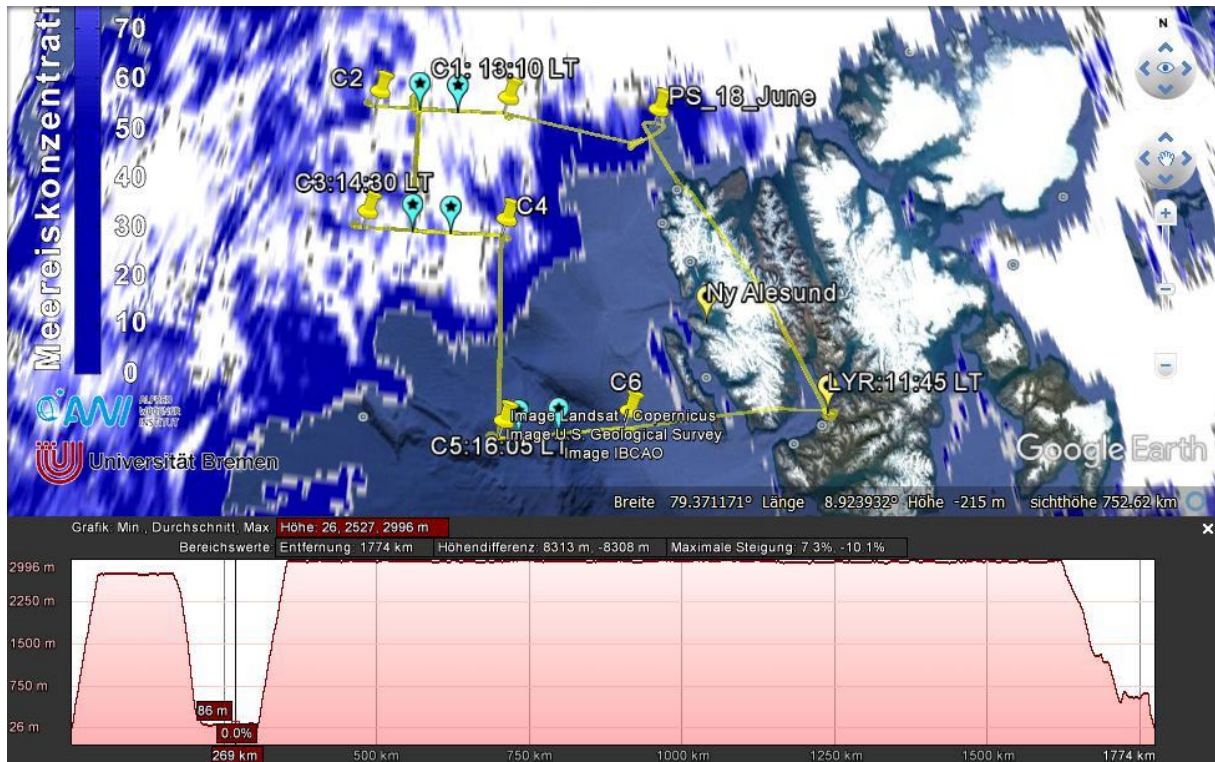
ECMW prediction of wind 950 hPa



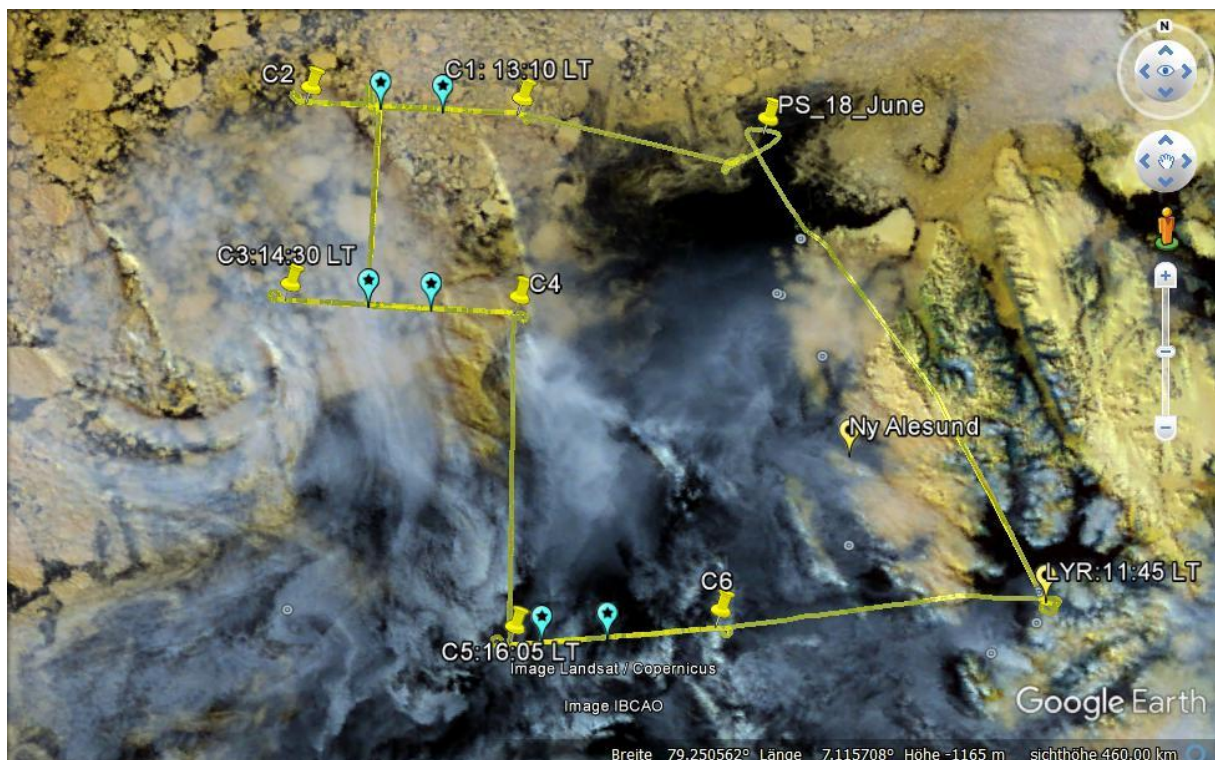
Overview of flight

The plan was the same as for the previous flight on Saturday. P5 should stay at 10,000 ft all the time. Between C1 and C2, C3 and C4, C5 and C6 we went back and forth (three times) and the P6 sampled the clouds in a collocated way by going back and forth between the green markers.

In reality we flew as follows (the times given on the waypoints are not correct):



Clouds were very thin, barely visible on the high resolution Modis picture.



Waypoints:

Waypoints:	PS	80° 18' N, 11° 12' E	
	C1 (15:35 LT)	80° 20' N, 5° 0' E	80.333° N, 5.000° E
	C2	80° 20' N, 0° 0' E	80.333° N, 0.000° E
	S2	80° 20' N, 1° 46' E	80.333° N, 1.766° E
	S3 (16:45 LT)	79° 33' N, 1° 49' E	79.550° N, 1.816° E
	C3	79° 33' N, 0° 0' E	79.550° N, 0.000° E
	C4	79° 33' N, 5° 0' E	79.550° N, 5.000° E
	C5 (18:10 LT)	78° 15' N, 5° 0' E	78.250° N, 5.000° E
	C6	78° 18' N, 9° 0' E	78.300° N, 9.000° E

Detailed Flight Log (all times in UTC)

LYR → PS → C1 Ascend to 10,000 ft **200 NM @ 160 kn** **95 min**

11:32 Motor on

Problems with SMART, are solved after a while, that's why the take-off is delayed.

12:02 Taxi

12:04 Take off

12:07 Little clouds during take off, ascending to 9200 ft, beautiful clouds ahead of us, no cirrus above

12:15 We reach 9200 ft, lidar switched on, just one layer of clouds, radar sees not much of it

12:33 Awesome clouds below, no cirrus above. We can see the edge of the sea ice in the clouds ahead of us, clouds distinctly stop at the ice edge.

12:42 We reach Polarstern in 100-200 ft



12:50 Surface albedo measurements in cloudless conditions close to Polarstern, partly over sea ice, partly over open water

13:05 We leave Polarstern

13:06 We start climbing

13:11 Partly cloudless

13:12 We reach 7000 ft

13:18 10,000 ft, nice clouds below

13:26 We reach C1, drop sonde **DS1**

<u>C1—C2</u>	<u>3 times, back & forth</u>	<u>50 NM @ 150 kn</u>	<u>60 min</u>
13:28-13:43	C1 → C2	10,000 ft	some cloudless spots, 13:38 many clouds below, first thin, but then getting thicker
13:49-14:03	C2 → C1	10,000 ft	clouds below us, not thick but okay, one can partly see sea ice, Marek distributes cake



14:05-14:22	C1 → S2	10,000 ft	many clouds in the south, we see two layers, below the shadow of the upper layer, the lower one disappears quite sharply.
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We circle around S2 and wait for P6 to arrive at S2, cirrus above
Cirrus above

14:26 We go to the south

<u>S2 → S3</u>	<u>46 NM @ 150 kn</u>	<u>20 min</u>
14:38-14:58	More thick clouds ahead of us, they seem different from those sampled between C1—C2. Very nice clouds below of us, nothing above, kind of hazy. Cloud top at about 1.5 km altitude. Radar doesn't see much from those low-level-shallow clouds. But they look highly reflective with probably many small droplets	



S3—C4	3 times, back & forth	54 NM @ 150 kn	60 min
14:45-14:58	S3 → C4	10,000 ft	very nice clouds below, no cirrus above, at the end of the leg clouds get thinner, party sea ice can be seen
15:02-15:17	C4 → C3	10,000 ft	clouds become always thicker in eastern direction, very nice clouds
15:21-15:39	C3 → C4	10,000 ft	DS2 (15:20), nice clouds below, nothing above, again clouds get thinner towards C4 (eastern direction). At the end of the leg there is a cloudless spot below.

C4 → C5	10,000 ft	78 NM @ 150 kn	32 min
15:40-16:10	at the beginning cloudless below and some patchy clouds, however, clouds start roughly at 15:42, very nice extended layer, although thin, we can see the remaining of some mid-level clouds ahead of us, these were predicted by ECMWF a day before, impressive, seems an endless, low-level cloud layer After a while the ice edge is reached, (at least at 16:04), glory		



C5 – C6	3 times, back & forth	10,000 ft	49 NM @ 150 kn	60 min
16:11-16:26	C5 → C6	10,000 ft	clearly different clouds compared to over sea ice, that's for sure, clouds getting more and more convective towards the East (similarly to the northern paths), some problems with catching GPS by the dropsonde, glory	
16:28-16:44	C6 → C5	10,000 ft	seems we observe specular reflection, might also be from the ground, DS3 at 16:41	
16:47-17:03	C5 → C6	10,000 ft	very nice clouds below, nothing above, DS4 at 16:59	
C6 → LYR			81 NM @ 160 kn	30 min
17:05	Heading home, very nice clouds towards LYR, we will try a "star track" for Elena's calibration of Hawk.			
17:11	Start descending toward LYR, lidar switched off			
17:20	Cloud penetration, maybe 5 min in cloud, cloud base about 3000 ft			
17:30-17:38	Star pattern for Elena (Boresight calibration)			
17:44	Touch down			
17:46	End of taxi			
17:53	Motor off			

Instrument Status

Polar 5	
Basis data acquisition	
Nose Boom	
MiRAC	
HATPRO	
AMALi	
SMART	
Eagle/Hawk	
Sun Photometer	
Drop Sondes	4 launched

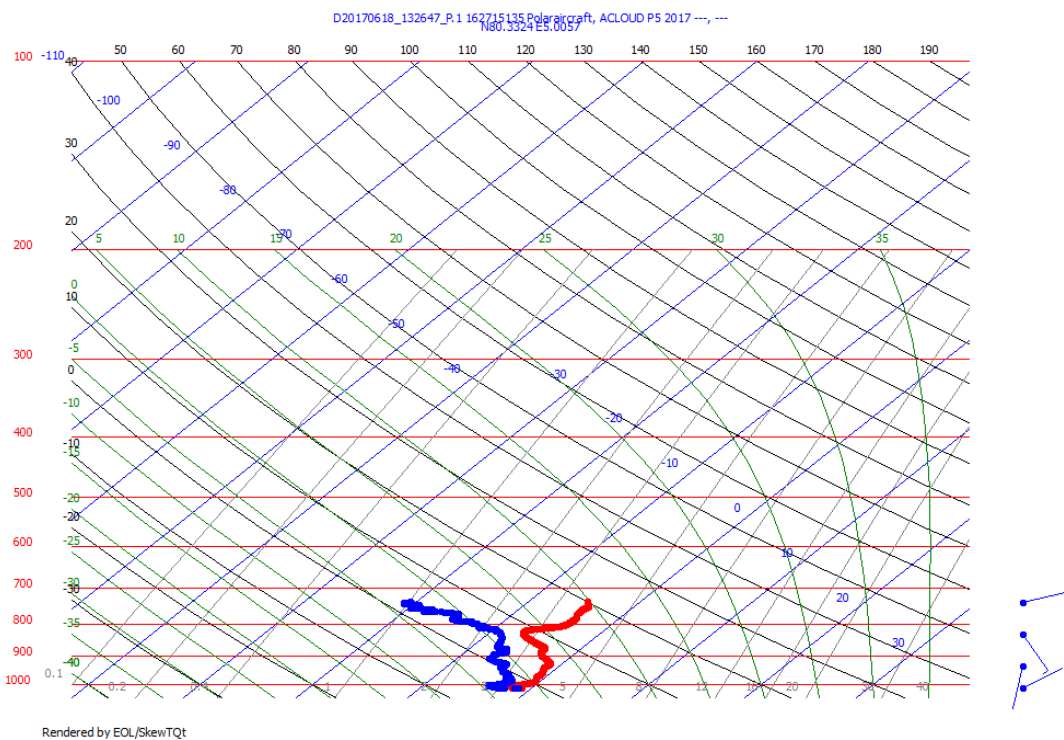
Comments

- Thanks to the crew!

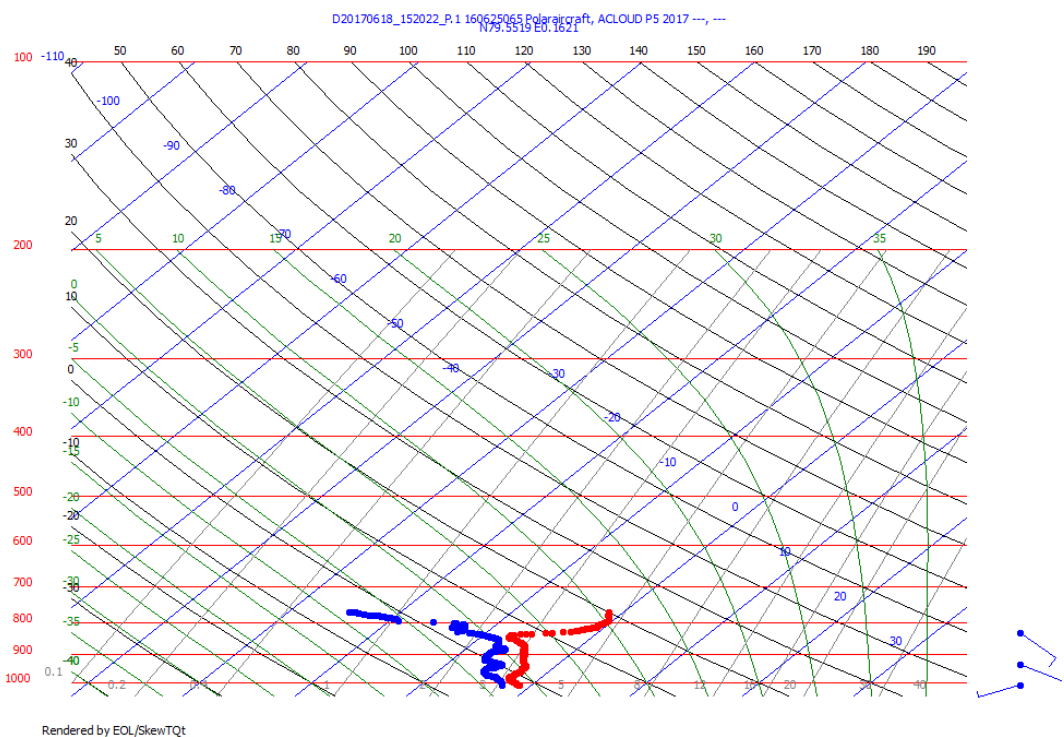
Quicklooks

Drop Sondes

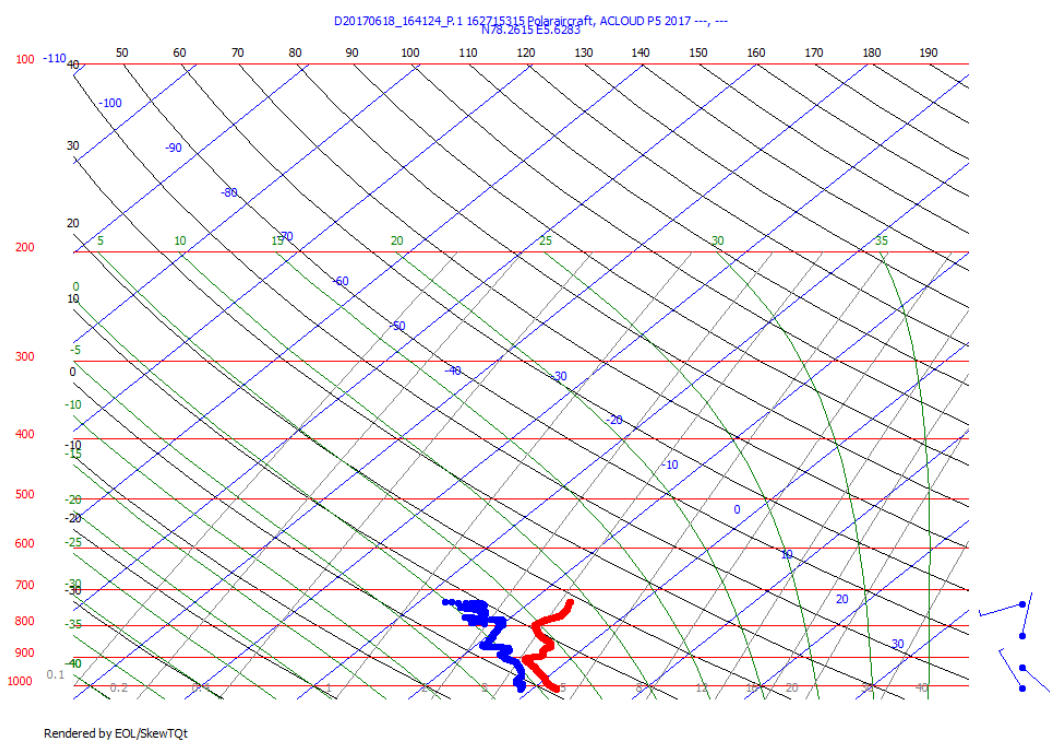
First dropsonde (DS1): 13:26 UTC



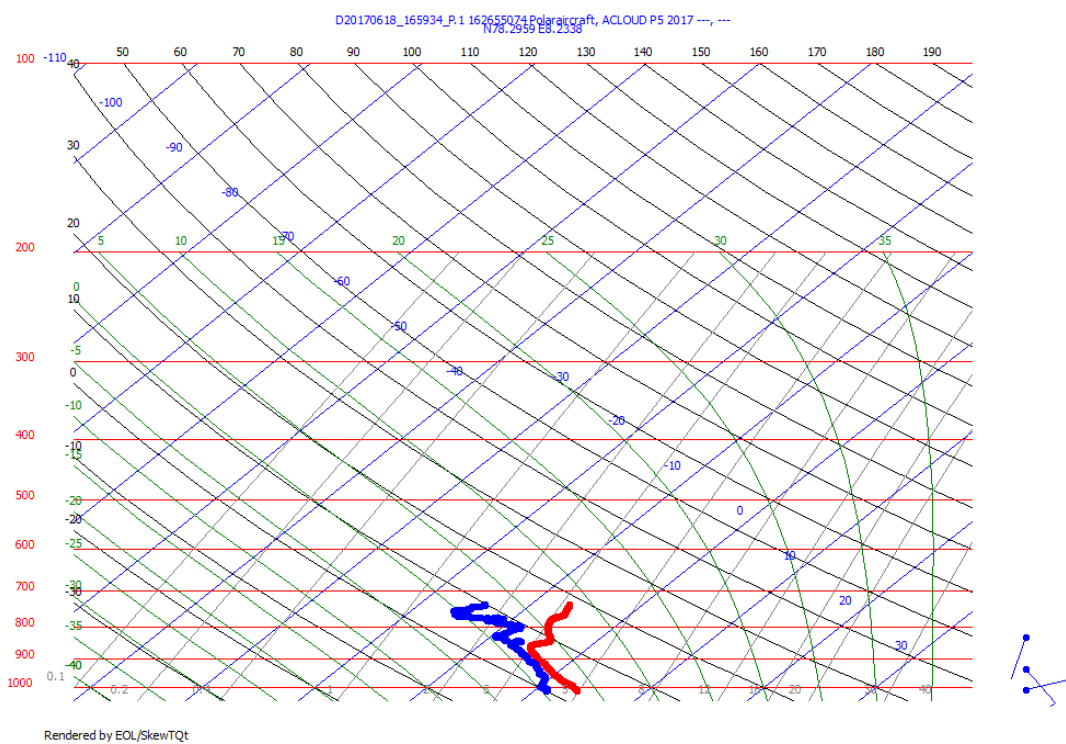
Second dropsonde (DS2): 15:20 UTC



Third dropsonde (DS3): 16:41 UTC

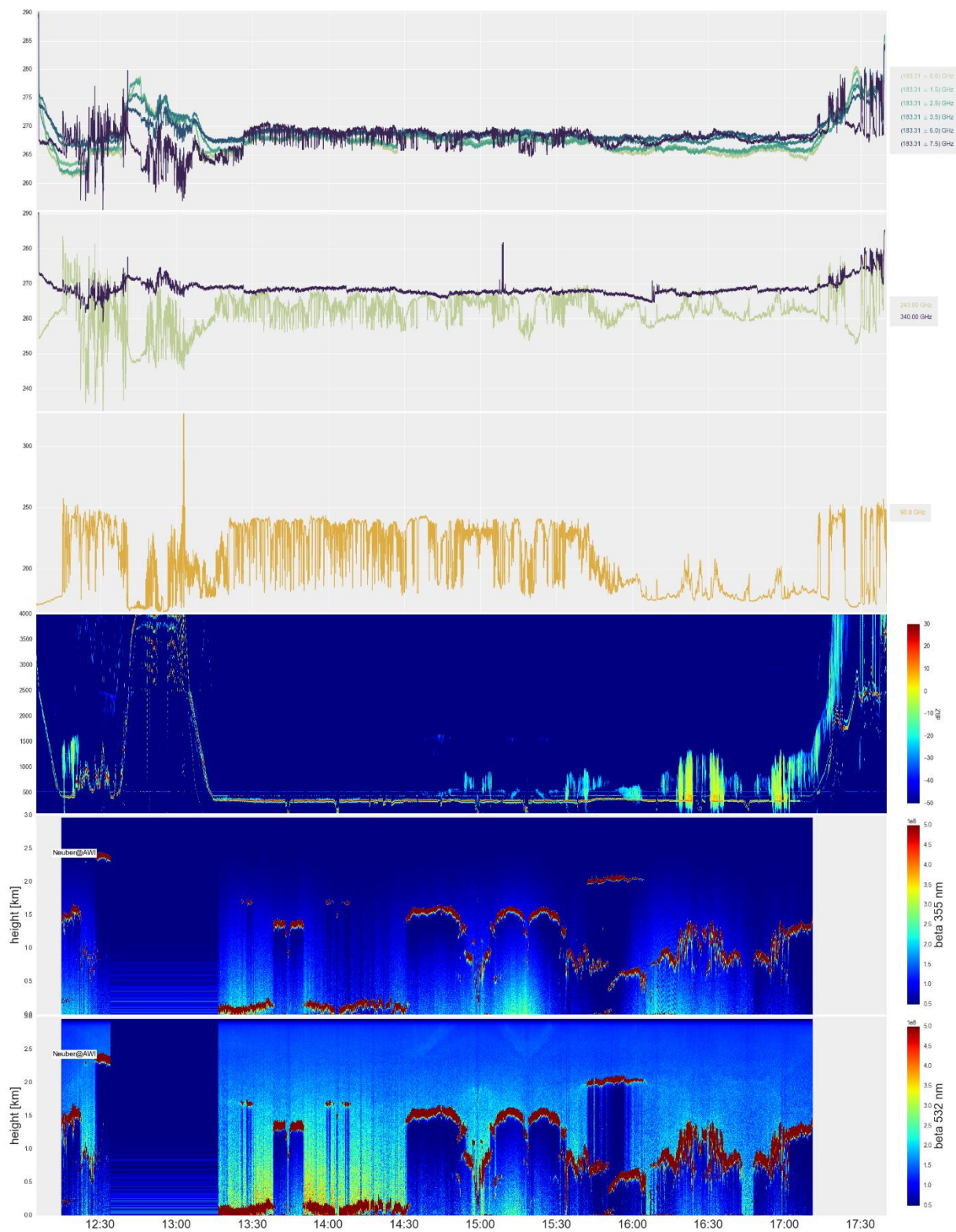


Fourth dropsonde (DS4): 16:59 UTC

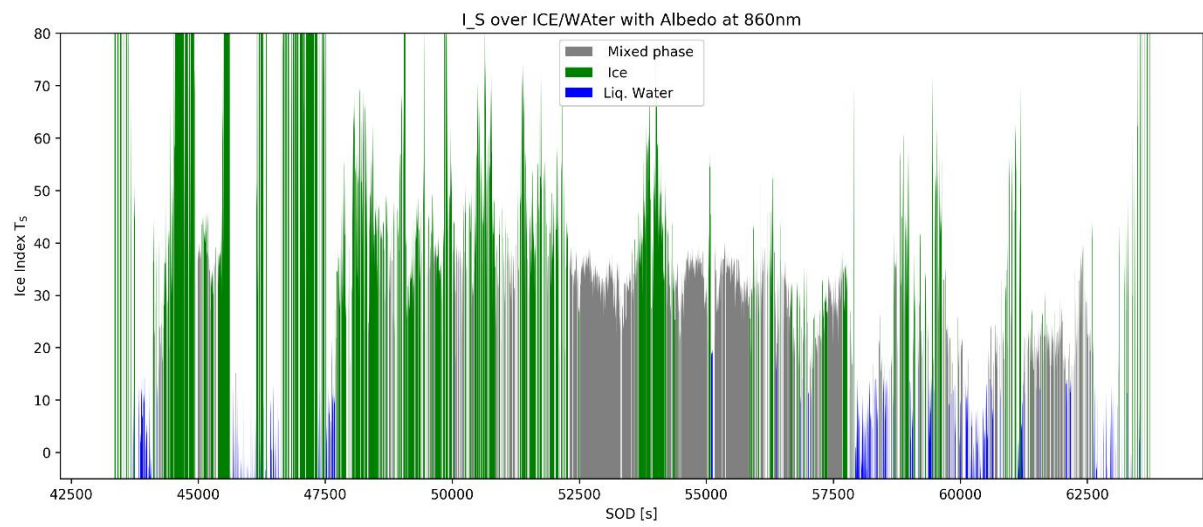
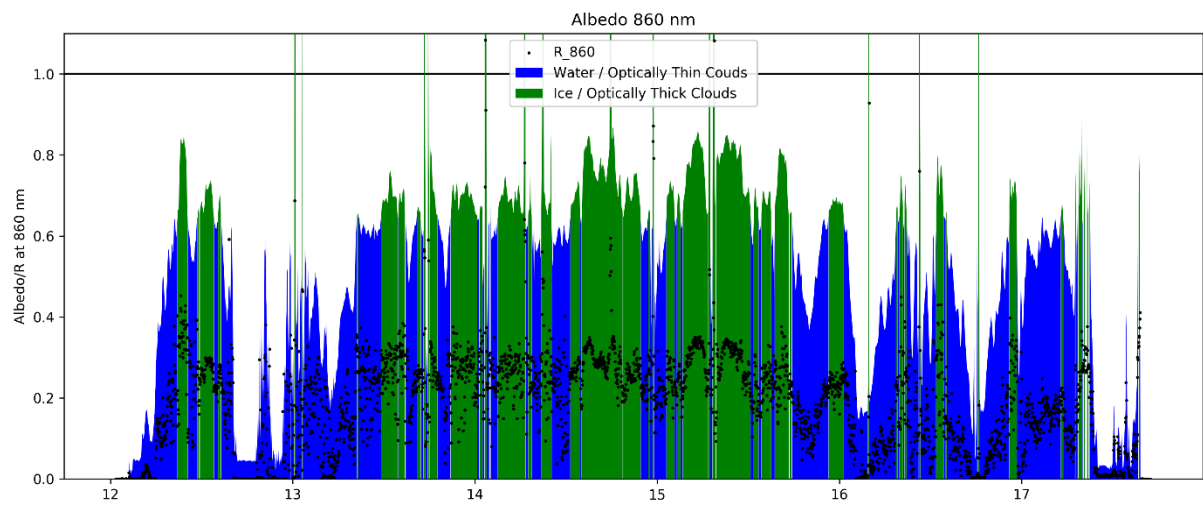


MIRAC & AMALI

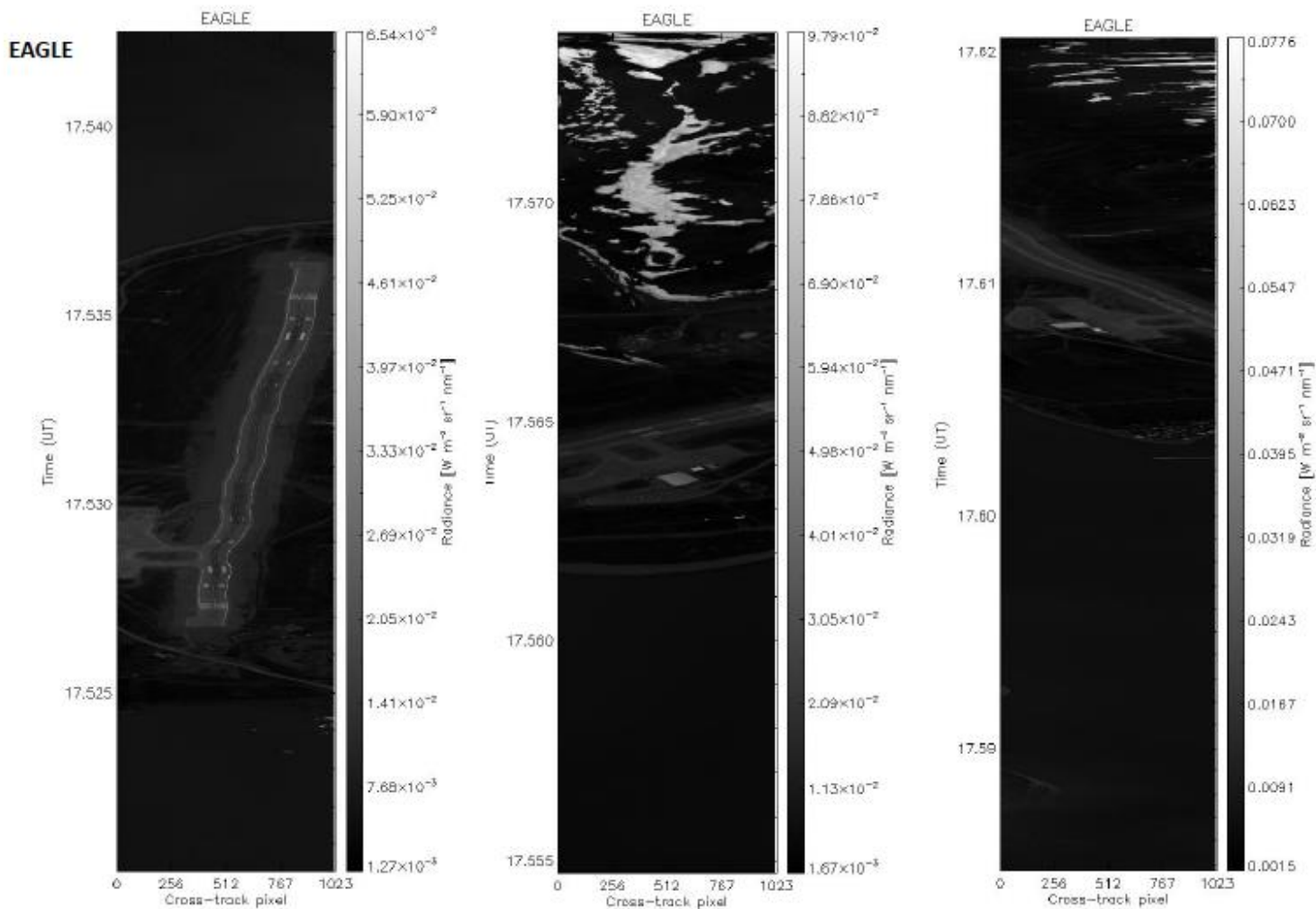
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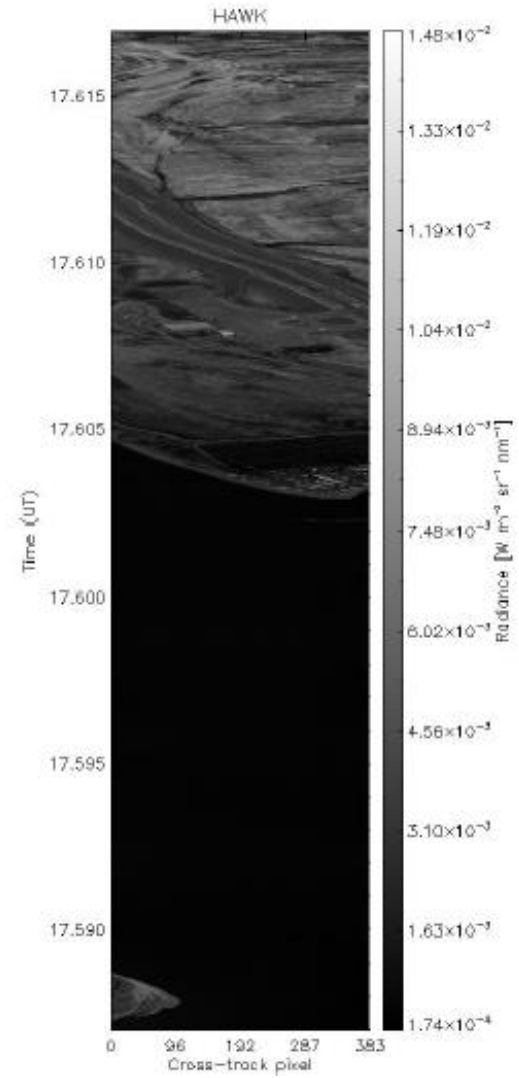
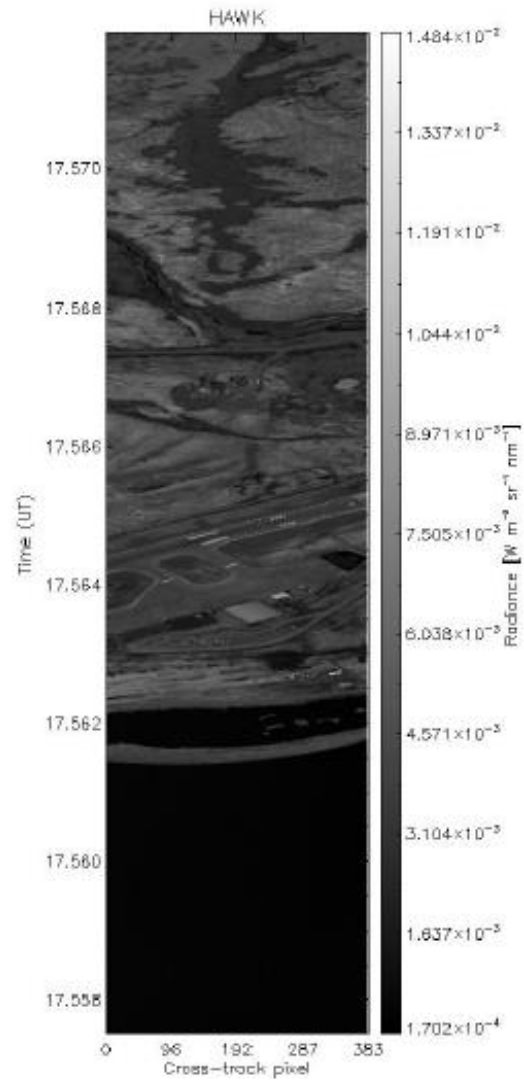
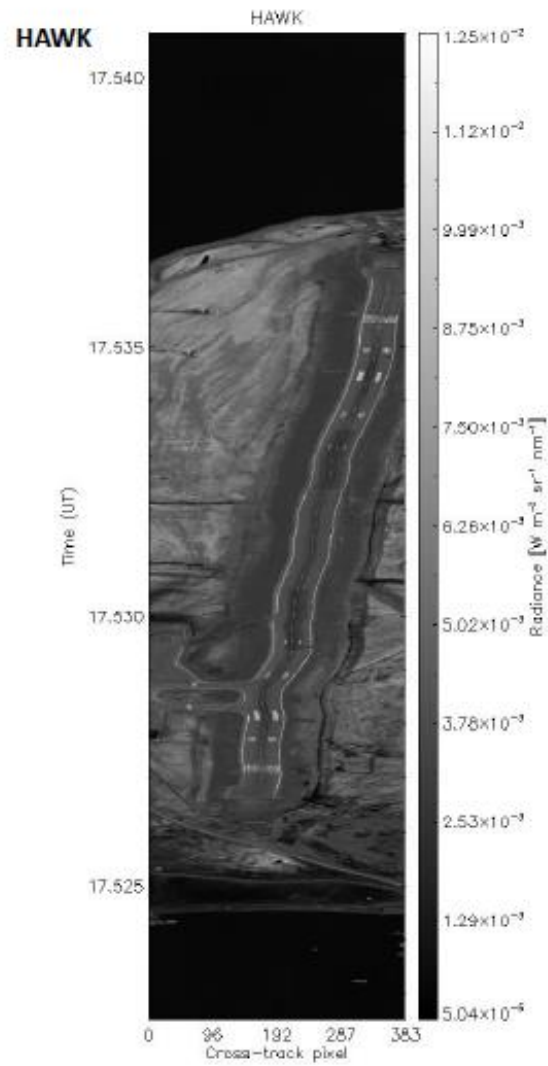
SMART



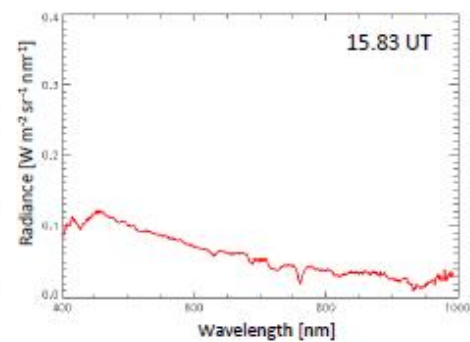
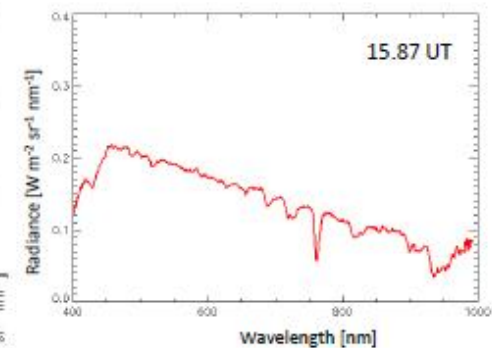
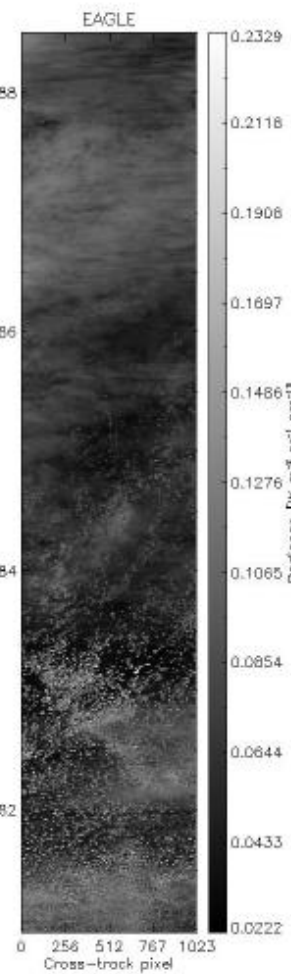
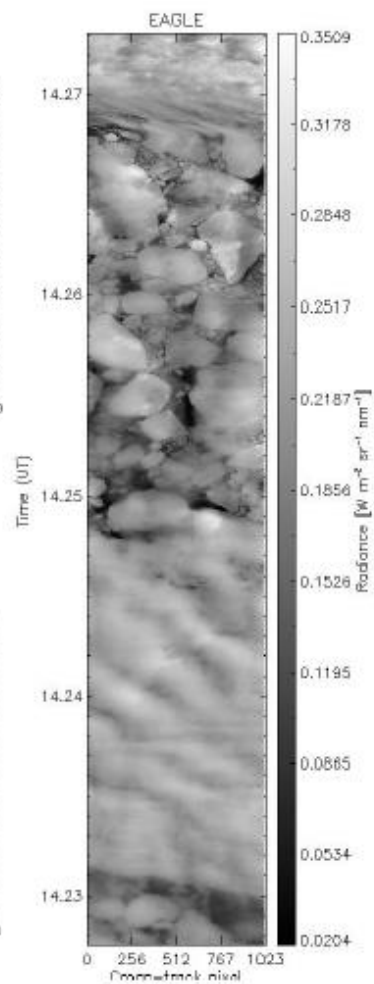
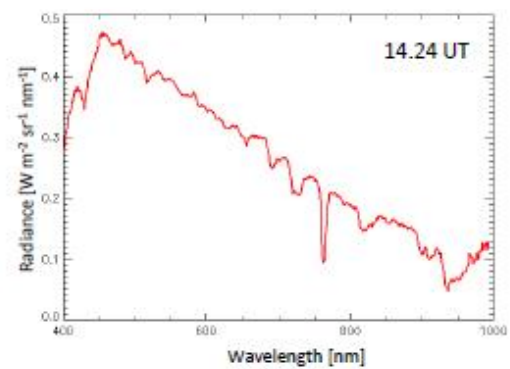
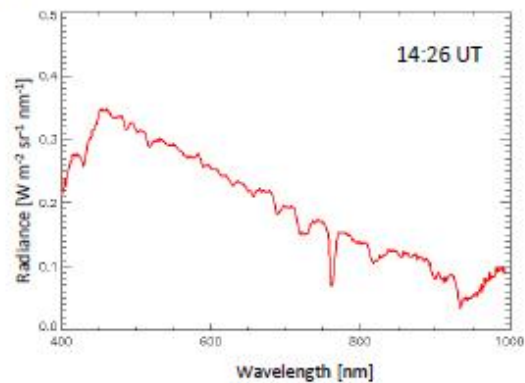
Boresight calibration



Boresight calibration



EAGLE



HAWK

