HALO-(AC)^3 – 2022/03/25 – Polar5 research flight #04

Objectives:

Boundary layer study over sea ice and open ocean during a coldair outbreak

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Mission PI P5: Christof Lüpkes christof.luepkes@awi.de

Polar 5 Crew	
Mission PI	Christof Lüpkes
Basis Data Acq.	Maximilian Stöhr
SMART/ Eagle/Hawk	Evelyn Jäkel
MiRAC / AMALi	Pavel Krobot/Imke Schirmacher
Dropsondes	Nina Maherndl

Flight times:

Polar 5	
Take off	11:22 UTC
Touch down	16:14 UTC

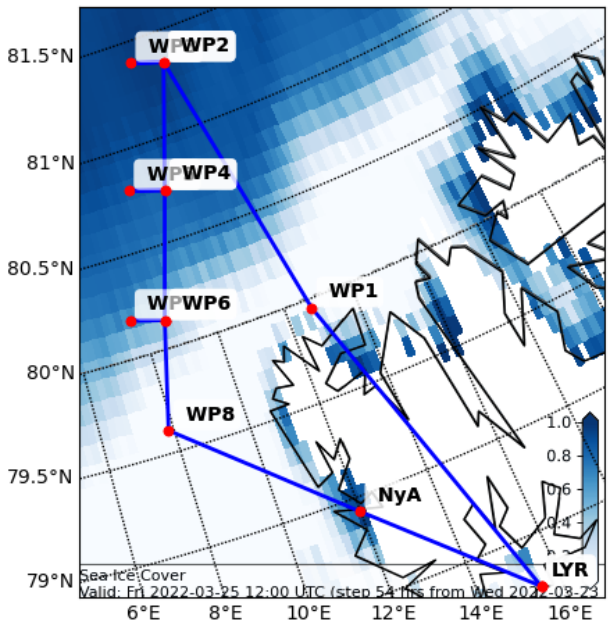
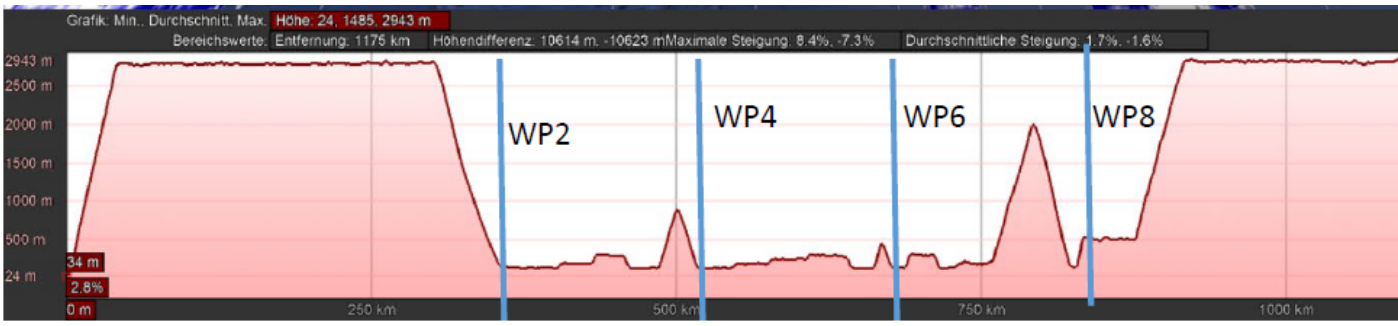


Fig. 1: Flight track as planned (left) and carried out (right). The left panel includes the sea ice forecast.



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

Forecast Maps:

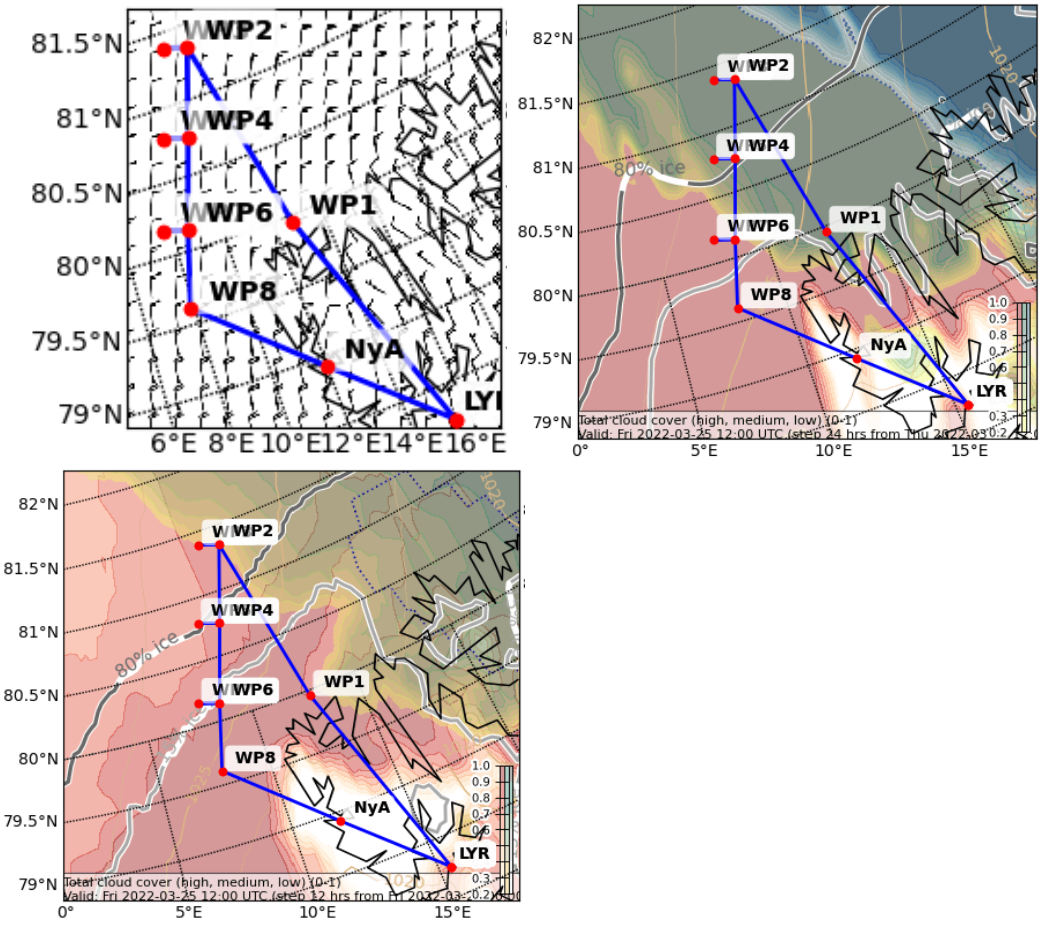


Fig 2: Top views of wind at 925 hPa (left), total cloud cover (ECMWF, middle, ICON, right) (blue: high clouds, green: middle, red: low), 12 hour forecast for flight day 12:00 Z.

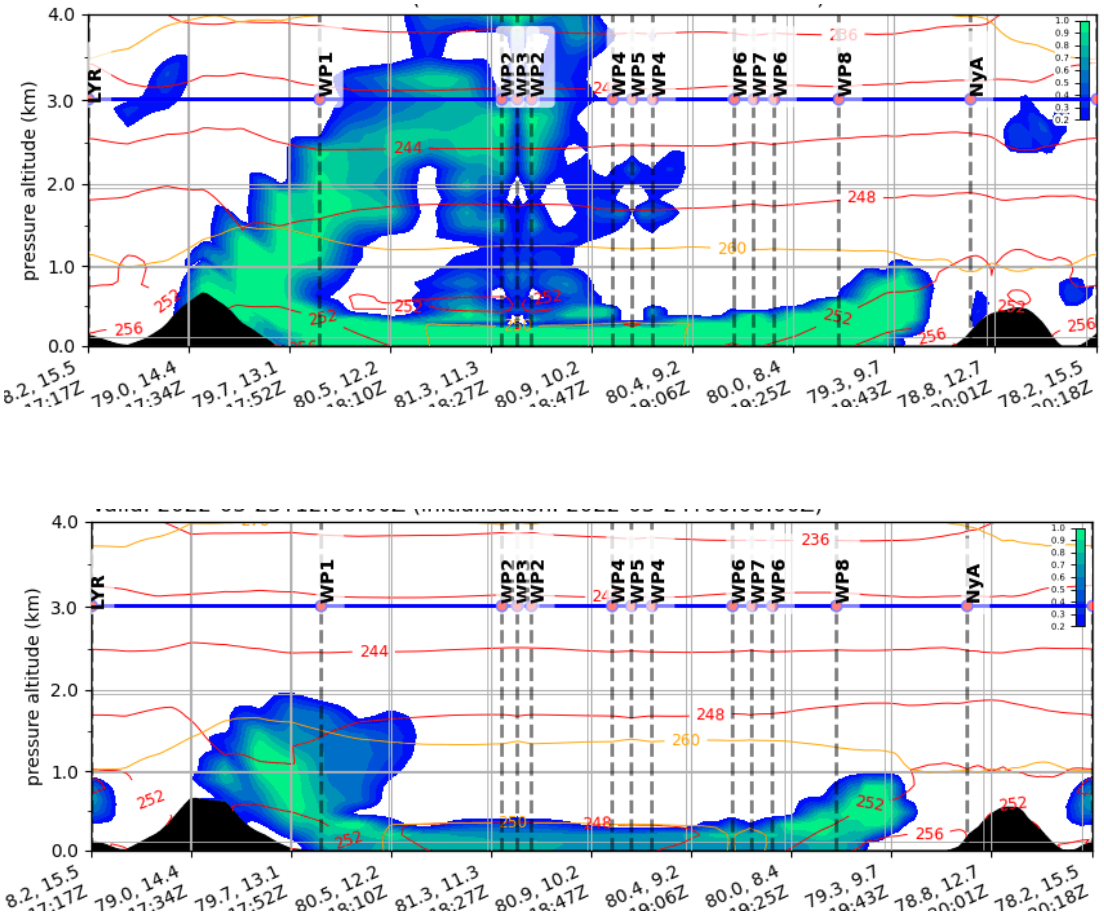


Fig. 3: Side views of clouds. 24 hour prediction of ECMWF (top) and ICON (bottom) for flight day 12 Z.

The observed wind field agreed well with the prediction. ECMWF and ICON showed similarities but also discrepancies for the predicted cloud fields. The predictions (especially ECMWF) suggested mid-level clouds at the northern coast of Svalbard. However, they were not at all observed during the flight. However, as both models predicted, a low stratocumulus layer occurred at the northern coast of Svalbard over the region with open water (Whaler's Bay polynya).

Over sea ice, almost no clouds have been observed except sea smoke developing over leads. Clearly, at WP2 the forecast of ICON was closer to reality with respect to mid-level clouds but it differed strongly from reality in the low-cloud cover. South of the sea ice edge (whose position agreed well with the forecast in Figure 1) a dense stratocumulus cover developed as being typical for coldair outbreaks. Their tops were at positions WP5 and WP7 roughly as predicted.

Overview:

The goal of the flight was to measure at first cloud fields by remote sensing between LYR and WP2 as well as the atmospheric structure by drop sondes. The larger part of the flight between

WP2 and WP8 concentrated on measurements of the mean and turbulent boundary layer structure over sea ice and open ocean. Our plan was to obtain 6 horizontal legs at WP2 and 6 legs at WP4. Due to the missing clouds a very low boundary layer height was observed and we reduced the program to 4 horizontal legs at each position. However, conditions were ideal for the measurement of sea ice reflection properties during clear sky. Since at position WP6 the ABL was still very shallow, we decided to move the WP6 stack of horizontal legs to WP8. But due to very bad visibility the pilots' decision was that no legs could be flown below 1500 ft. But at least 2 legs were flown at this altitude.

Major notes: Unclear if noseboom is working.

Instrument Status:

Polar 5	
Basis data acquisition	
Nose Boom	unclear
MiRAC-A	
MiRAC-P	
AMALi	
SMART	
Eagle/Hawk	
Sun Photometer	
Drop Sondes	

Table S5.1: Instrument status as reported after the flight for all instruments on Polar 5.

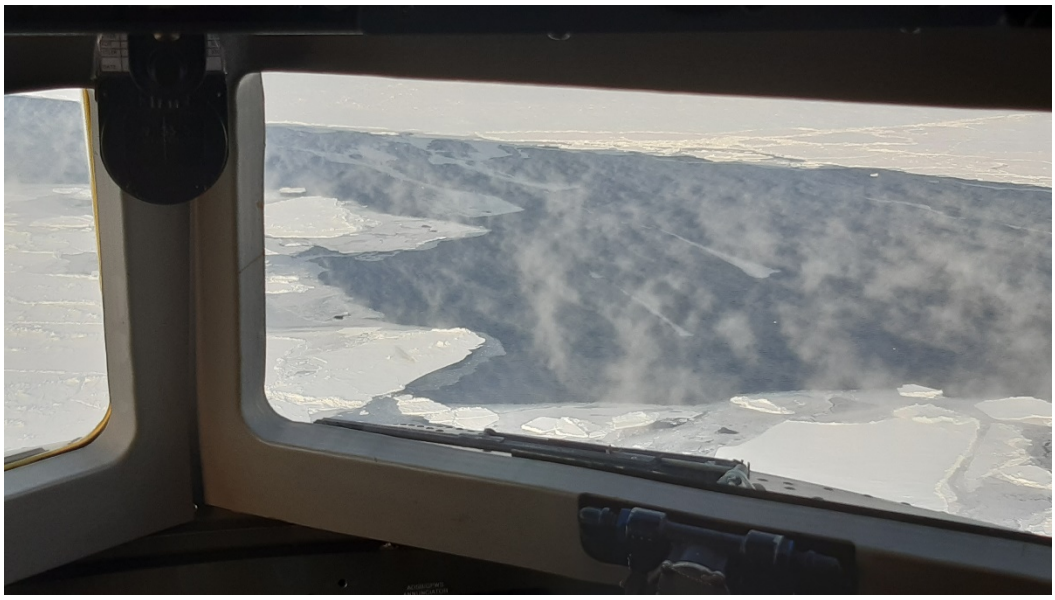
Detailed Flight Logs:

→ Three dropsondes betweenWP1 and WP2 from 10.000 ft. Another one on the track towards south after WP8 (extended towards south relative to planned flight track).

→ No clouds were observed except some very thin layers with unclear height north of our pattern (see above). Sea smoke was clearly visible over several leads (especially strong close to the edge of packice (see photo).

→ sea ice conditions in particular areas/legs

Almost 100 % sea ice cover at WP2



Approaching the sea ice edge near WP6

Sea ice edge at WP6 (80.2 N)

Quicklooks: