

HALO-(AC)³ – 2022/03/29 – Polar6 research flight #06

Objectives:

- * Perform twice detailed, precisely executed stack profile patterns with double legs for the nose-boom probe. The first pattern over the ice, the second one further Southwest over open water.
- * Perform in-situ cloud measurements in the southern part over the sea. The same for the aerosols where ever possible.
- * Perform trace gas measurements of sufficient duration especially at higher altitudes.

Mission PI P6:

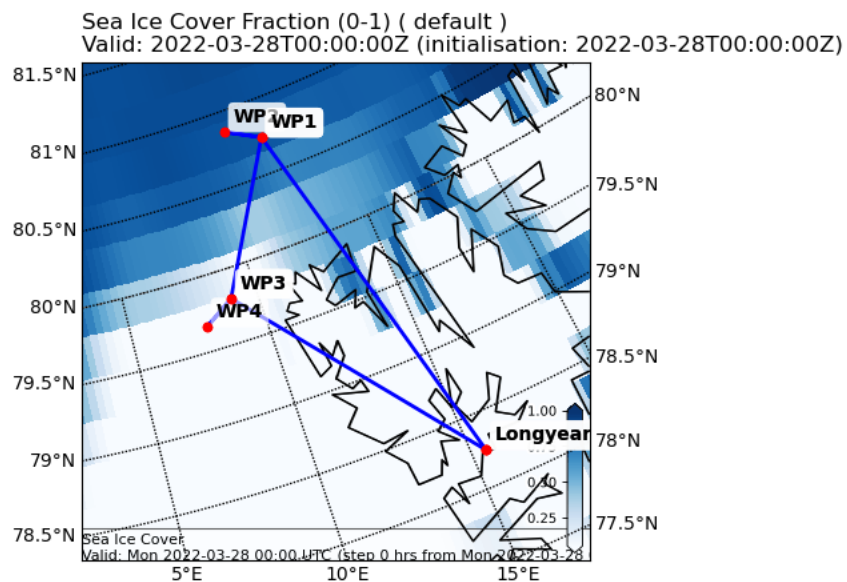
Stephan Borrmann

Polar 6 Crew	
Mission PI	Stephan Borrmann
AWI 1	Dennis Ludwig
AWI 2	Dirk Kalmbach
CVI/Aerosol/HERA	Bruno Wetzel
ALABAMA/trace gas	Oliver Eppers
PMS	Johannes Lucke

Flight times:

Polar 6	
Take off	12:17 UTC
Touch down	17:45 UTC

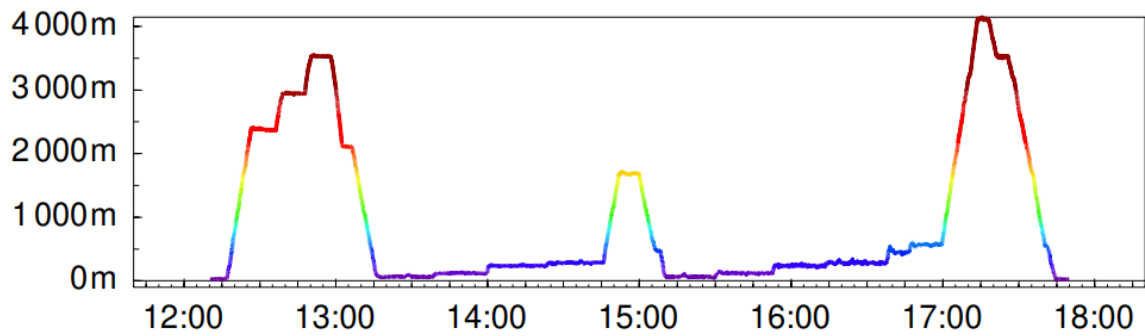
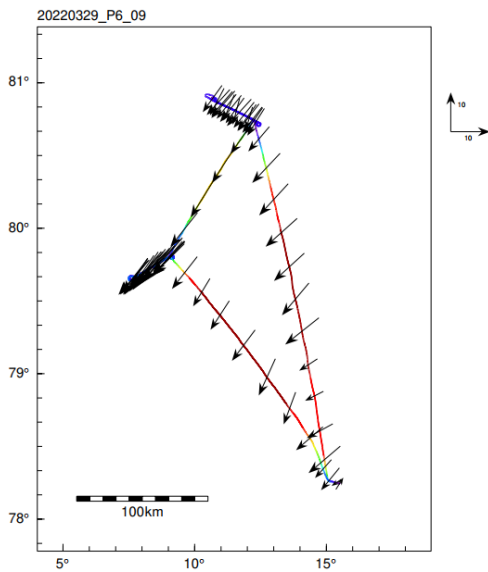
Intended flight plan:



20220329_P6
EPSG:77752350

The flight was very executed as planned (see map below), even down to small details. Especially the “hair pins” for the nose boom calibration and turbulence measurements were very precisely flown. For this a pattern had to be flown, where it was necessary to fly each leg twice following exactly the same line at the same altitude and speed during both runs. At the turns over the ice the aircraft was

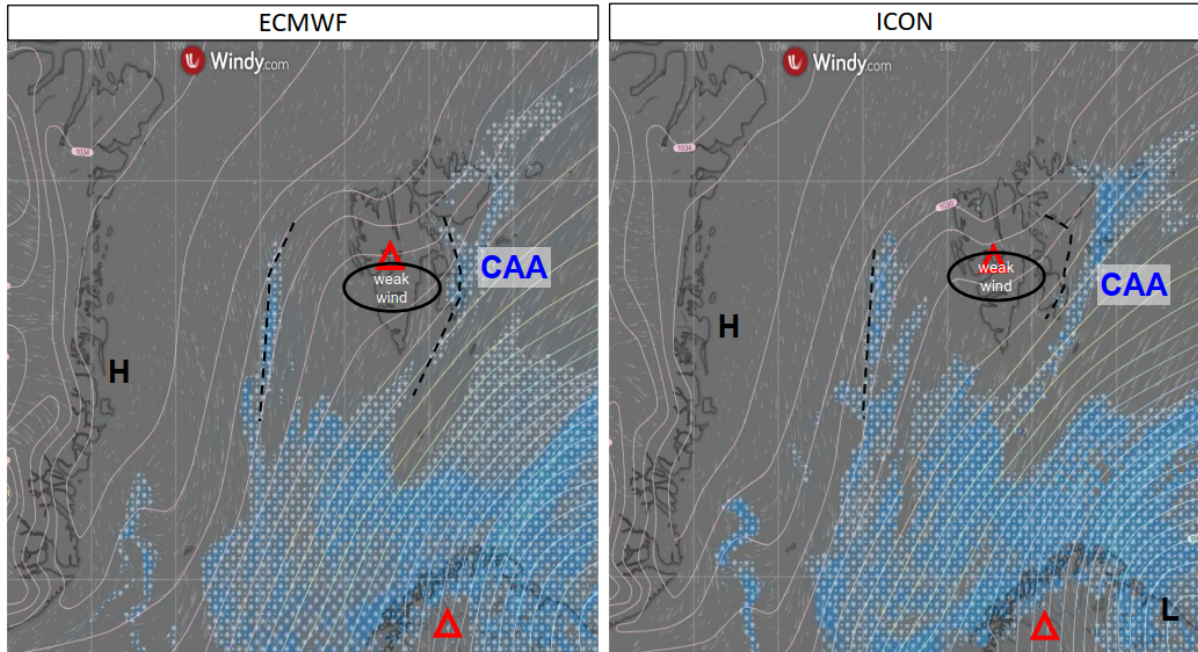
“bumped once by turbulence” at the 200ft and 400 ft levels when coming back onto the same flight track. In these bumps P6 encountered its own self-generated turbulence. This demonstrates how precisely the two flight tracks were positioned directly on top of each other.



In the vertical profile of the flight (as shown above) the stacked nose-boom patterns are discernible between 13:15 and 14:45 (WP1 ↔ WP2), and between 15:10 and 17:00 (WP3 ↔ WP4).

Weather situation as observed during the flight:

Tuesday, 2022-03-29 12 UTC (+36 h)



The cold air outbreak with the northerly flow continued to persist as during the last week. This can be seen in both, the ICON and ECMWF forecasts. Clouds were forecasted and encountered in the southern part of the flight in the region around WP3 and WP4. At first this was a shallow stratocumulus deck (see left picture) between roughly 400 ft and 2000ft, which later during the execution of the stacked pattern between these way points turned into a more broken deck of stratocumulus perlucidus. (One stacked pattern takes more than 75 mins.) Before entering the cloud deck, when moving from WP3 towards WP4, a dense field of cumulus mediocris and cumulus humilis with voids in between was crossed at ca. 1700 ft. Below the stratocumulus deck there was a precipitation zone (see right picture).



Overview:

* Stacked pattern for the nose-boom calibration and turbulence measurements: Both nose-boom hairpin patterns were precisely executed as planned. These patterns consisted of double legs of 7 min each between WP3 and WP4 at altitudes: 200ft (110kts), 400ft (120kts), 800ft (130kts), and 1000ft (110kts). The same pattern was flown between WP1 and WP2 over the ice at cloud free conditions.

* Between WP3 and WP4 two unplanned extra „one way legs“ were performed on top of the other nose-boom legs. One of these extra legs was inside the clouds at 1700ft, the other one above clouds (ca 2000ft) at/or above the inversion (ca 1500ft). This way the cloud instruments sampled roughly 3 minutes on each of the hair-pin altitudes at 200ft, 400ft, 800ft, 1000ft PLUS the extra two levels at 1700ft and 2000ft.

* The aerosol measurements benefitted from the long double flight legs in the stacked nose-boom patterns.

* Outbound and inbound to and from LXR trace gas steps were flown at 7kft, 8kft, 10kft, 12kft, and 14kft. Each step was coordinated with the instrument operator such that a step lasted about 7 minutes. This is enough time for a CO/CO₂ calibration at each level plus several measurement points. Also aerosol measurements of good statistics were possible on these altitude levels.

Instrument Status:

CVI was working throughout the entire flight and used inside the clouds.

Trace gas was working continuously, and especially on the “trace gas altitude steps”.

Polar nephelometer was operating continuously

Nevzorov probe: malfunction.

ALABAMA worked without problems during the whole flight and delivered data of the expected quality.

PMS instruments and **SP2** were working.

HERA sampler was running.

Aerosol and Trace gas instruments continuously measured throughout the flight

Nose-boom: was working, only the unusual values for beta persisted as in the previous flights.
