

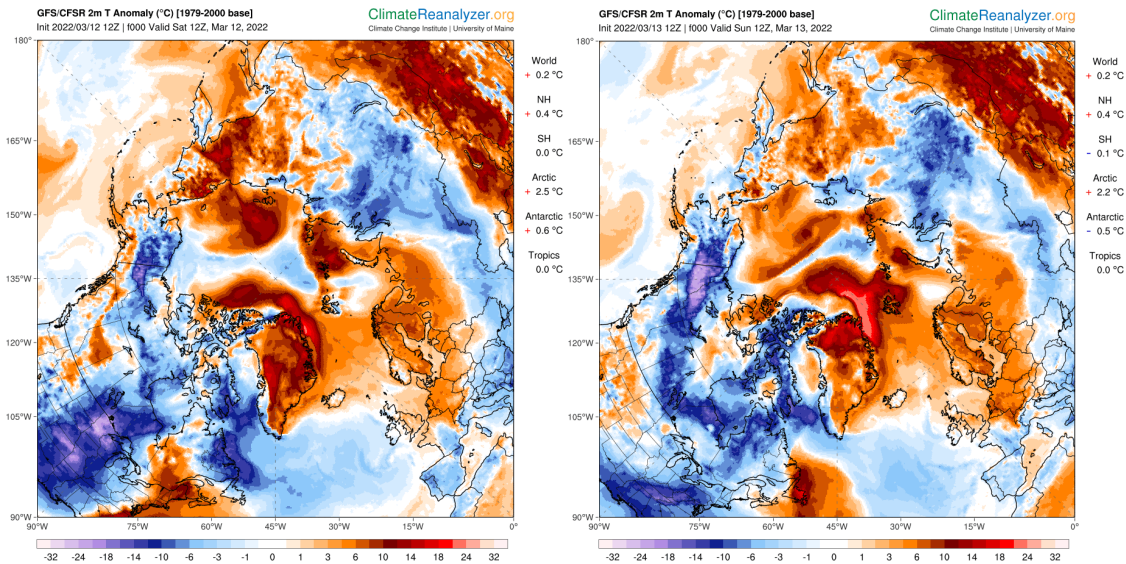
# Flight Report

## HALO-AC3\_HALO\_20220313\_RF03

### Warm Air Intrusion 1—Day 2

#### Objectives:

- Second of three consecutive flights looking at the same Warm Air Intrusion 1 (WAI1)
- Compared to the previous day the exceptional warming even intensified and spread across the sea ice into the the Fram Strait towards the Pole
- To investigate surface-atmosphere interaction cross sections over the warm intrusion covered the transition between open ocean and sea ice



[https://climatereanalyzer.org/wx/fcst/?mdl\\_id=gfs&dm\\_id=arc-lea&wm\\_id=t2anom](https://climatereanalyzer.org/wx/fcst/?mdl_id=gfs&dm_id=arc-lea&wm_id=t2anom)

#### Mission PI HALO:

| HALO Crew   |   |
|-------------|---|
| Mission PI  | Susanne Crewell                           |
| HAMP        | Lutz Hirsch                               |
| WALES       | Silke Gross                               |
| SMART/VELOX | Michael Schäfer                           |
| specMACS    | Maximilian Ringel                         |
| Drosondes   | Benjamin Kirbus                           |
| Camera      | Sebastian Schmidt                         |
| Pilots      | Marc Puskeiler<br>Michael Grossrubatscher |
| Engineer    | Thomas Leder                              |

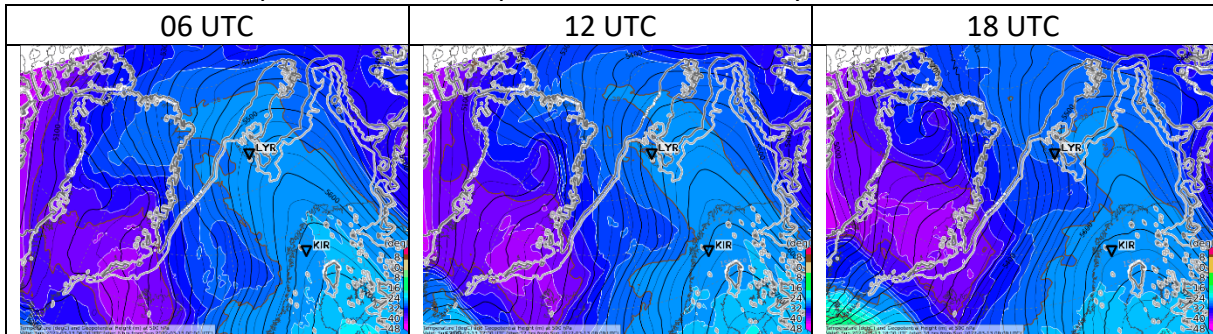
#### Flight times:

| HALO       |           |
|------------|-----------|
| Take off   | 08:22 UTC |
| Touch down | 16:44 UTC |

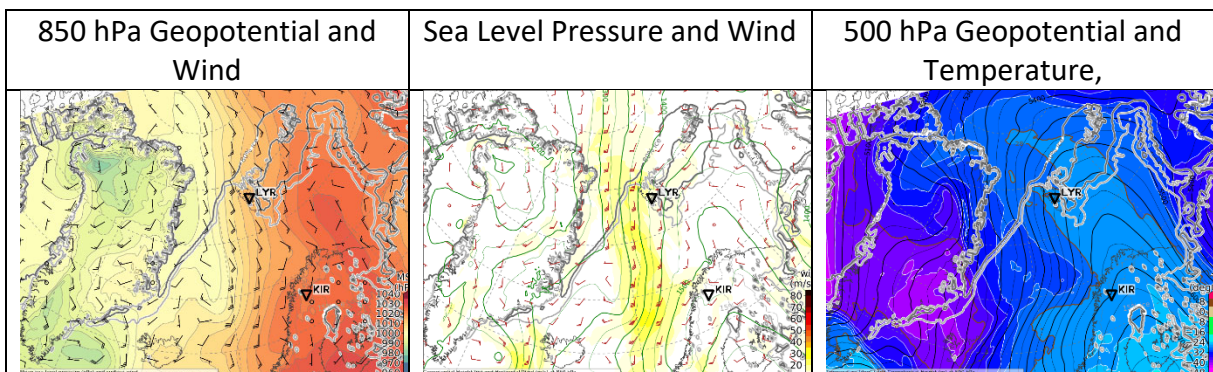
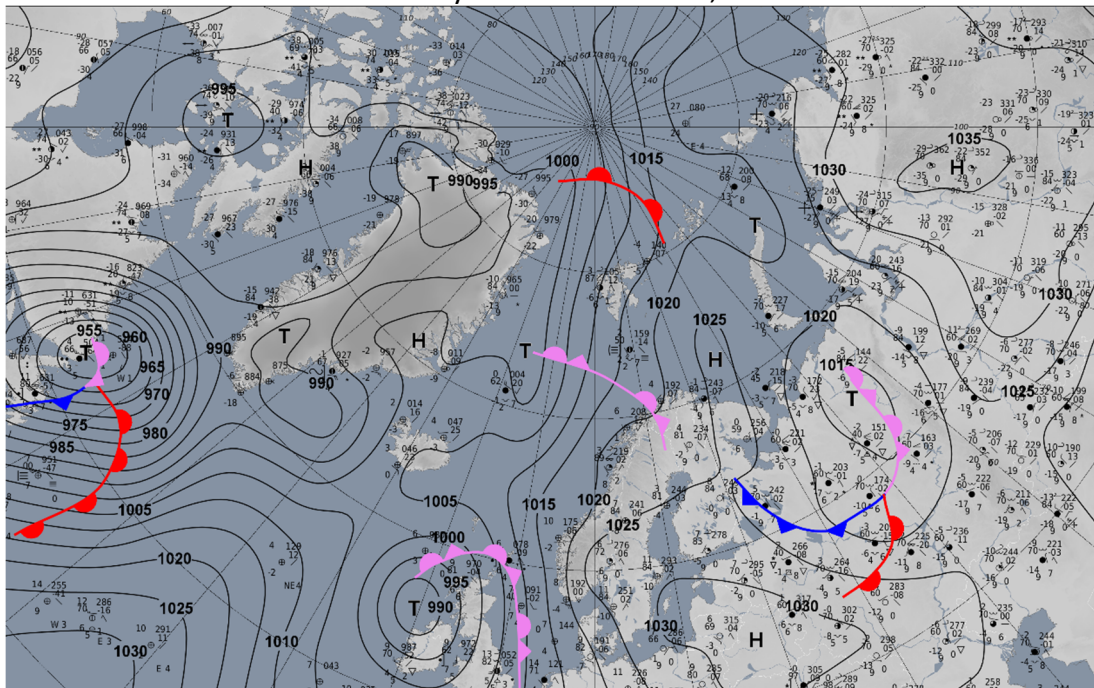
**Weather situation during the flight:**

The strong ridge from yesterday with a north-westerly axis was still pronounced in the morning and slightly tilted its axis even further to the north during the day. This led to a steady flow from the south at all altitudes (500 hPa, 850 hPa, sea level) bringing moist air directly from Mediterranean into the Arctic. The warm front marking the progress of the warm and moist airmass reached about 86 N at 12 UTC as evident in the surface analysis.

500 hPa Geopotential and Temperature, ECMWF analysis, 13 March 2022

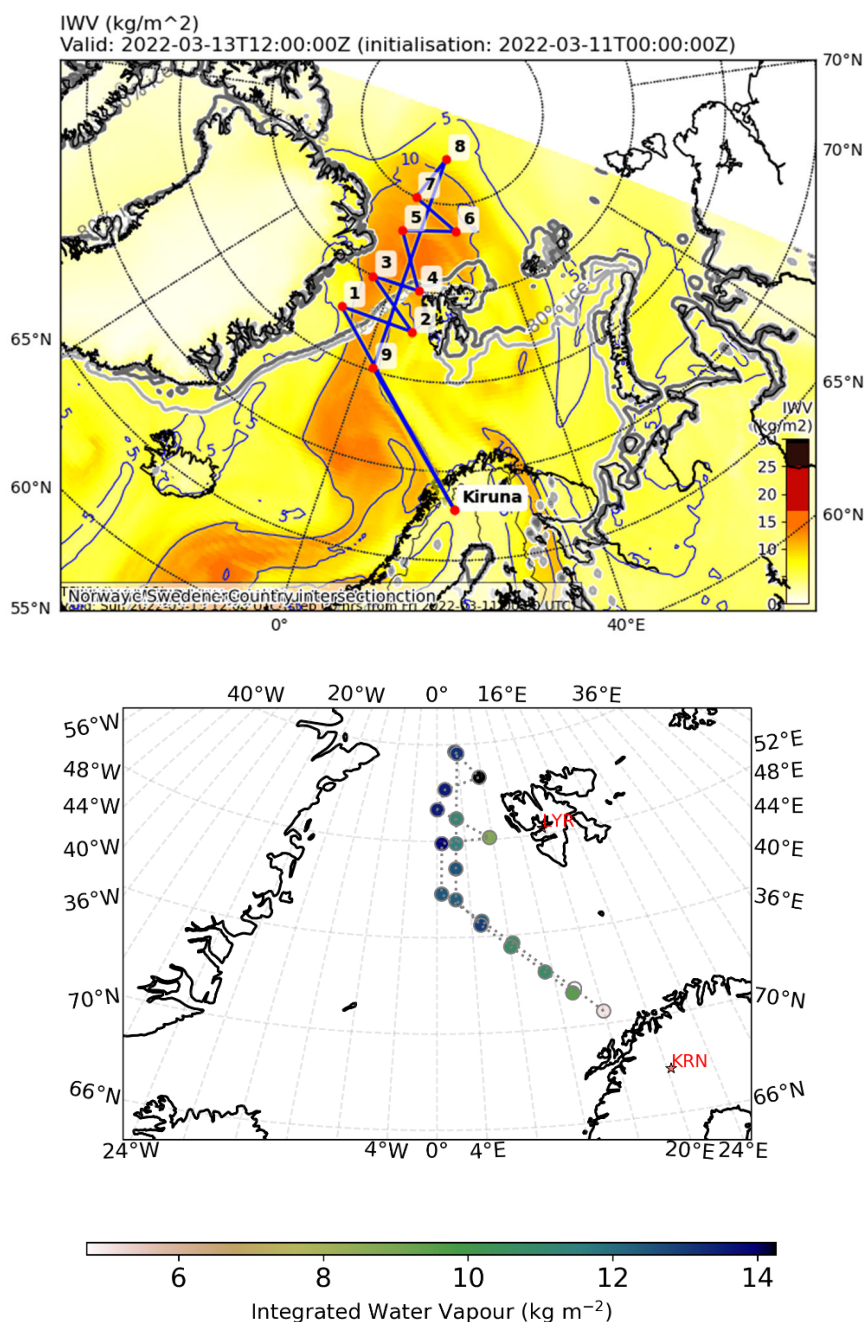


DWD Surface Analysis: 13 March 2022, 12 UTC



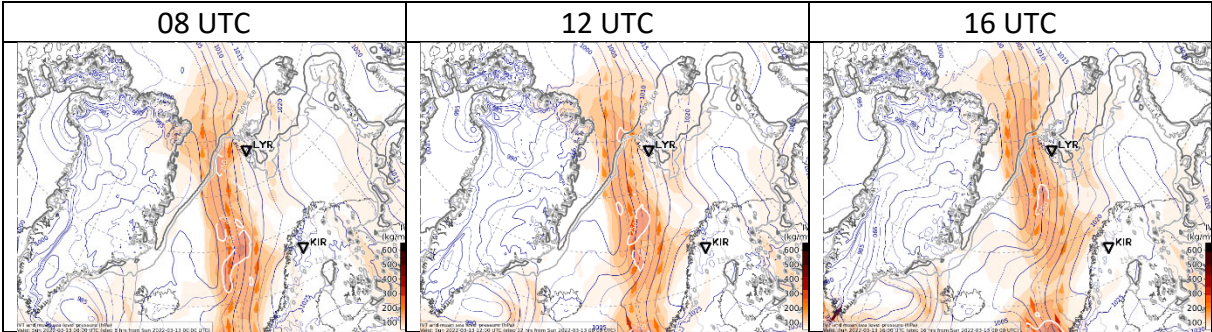
### Overview of flight:

The flight pattern aimed to characterize the strong warm air intrusion with straight northward flow of humid air and associated clouds and precipitation. The flight started directly from Kiruna with a transect through the moist tongue at around 75 N covering the sea ice edge and continued northward with in total 7 transects of the moist air mass. Three transects passed the sea ice edge (grey lines in figure below) contrasting conditions above water and ice. 24 drop sondes were released (2 did not work) showing the increase in water vapor with latitude (see positions of dropsondes below by Geet). The flight started at FL410 (about 12.5 km) and after 2.5 hours we climbed slightly higher to FL 430 as high clouds disturbed the lidar measurements.

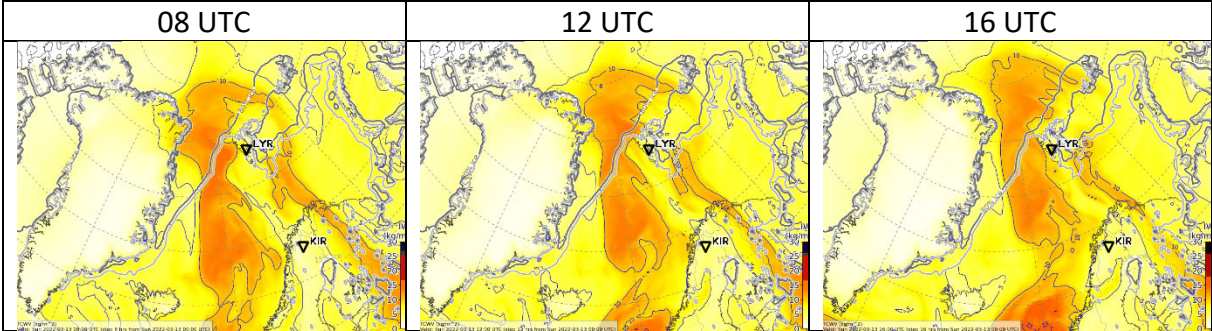


The vertically integrated water vapor and transport fields are also shown in their successive order throughout the flight (8, 12, 16 UTC). Clouds in multiple levels were observed with overlying cirrus most of the time as also seen by ECMWF analysis and with the radar shown below.

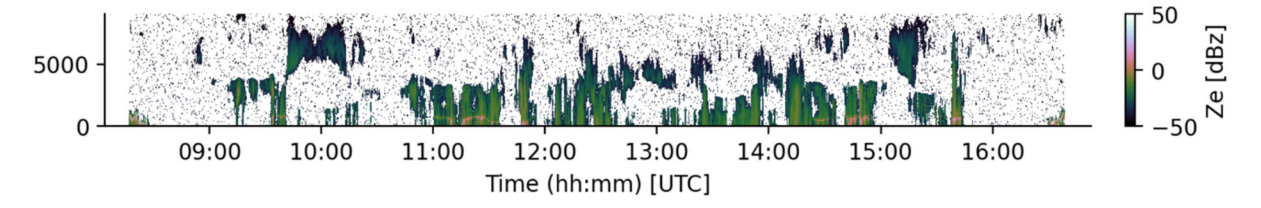
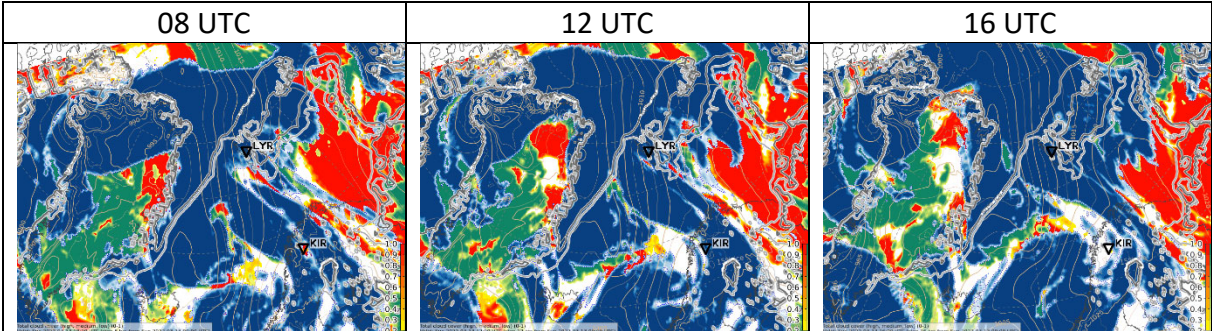
Vertically Integrated Water Vapor Transport (IVT), 12 March 2022



Vertically Integrated Water Vapor (IWV), 12 March 2022



Cloud Cover and Sea Level Pressure, 12 March 2022







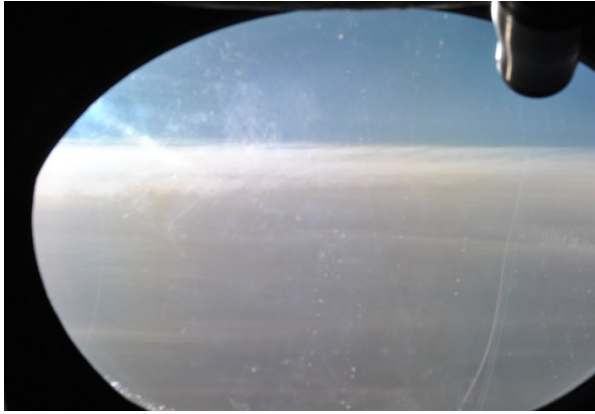
**Instrument status**

| HALO            |  |
|-----------------|--|
| BAHAMAS         |  |
| BACARDI         |  |
| HAMP Radar      |  |
| HAMP Radiometer |  |
| WALES           |  |
| SMART           |  |
| VELOX           |  |
| specMACS        |  |
| Dropsondes      |  |

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

**Flight Impressions (start 8 UTC)**

|   |  |
|---|--|
|     |   |
| 8:16 view across Norwegian border   | 9:36:03 after crossing water vapor max   |
|    |  |
| 10:36 around turn, interesting multi-layer structure with shadows, 2 Sc + Alto-clouds | 11:40 Svalbard comes into view – open ocean with waves; some whitecaps + ice         |



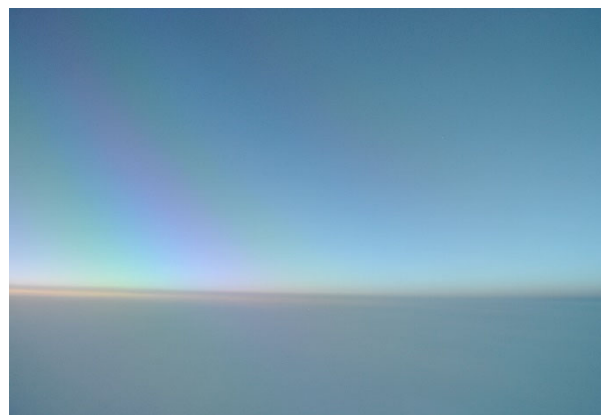
12:49 Clouds at flight level, above Sc layer below, nothing in between



13:15 getting dark at WP7 (85 N)



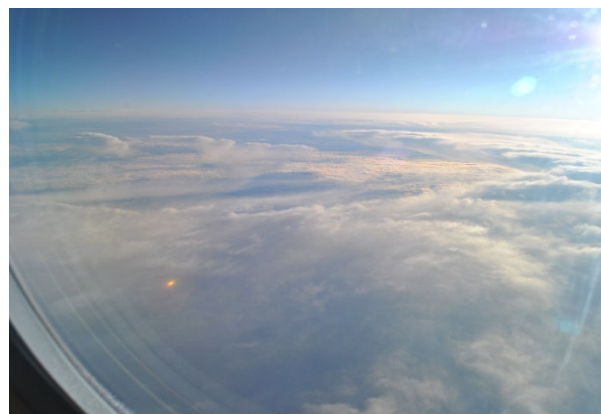
13:37 extensive Sc below, with almost completely transparent high-level cloud above, and smoke layer well visible



13:40 looks like northern lights + sun re-appearing + smoke layer concentrating near the pole



14:49 contrail; Sc are becoming more convective now, second layer



15:38 Now the clouds are more mixed again – high, low, mid-level....

16:30 Norwegian coast

17:00 landing

Thanks to the team!

