

CloudBrake Flight 1 (CBRF1), Allgäu, May 24, 2019 (11-13:30 CEST)

D-FDLR (Cessna):

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D-CMET (Falcon):



Figure 1: Photographs showing the boundary layer and inversion, near the probe (left), the first shallow cumuli viewed from above cloud tops (middle) and the developing cumuli over the Swäbische Alpen, also frequently targeted by gliders (right).

Weather conditions and clouds:

This flight measured clear-sky convective boundary layers and shallow-cloud topped boundary layers under weak wind conditions during midday. After a number of overcast days and heavy rain, Southern Germany was under the influence of a broad area of high pressure west of Europe and over the Northern Atlantic. The atmosphere was relatively dry, with a pronounced inversion and weak winds without a strong directional component. During the transfer flight towards Allgäu, and the southern part of our north-south oriented leg, skies were predominantly free of shallow cumulus. Plenty of cirrus and contrails were around, but high and thin enough to allow the wind lidars above the Falcon to view the lower atmosphere. Only over the Swäbische Alpen on the northern part of the leg, numerous locally driven shallow cumuli (cumulus humilis) developed, with cloud base near 2 km and tops near 2,5 km. These were the focus of our measurements.

Flight pattern:

Two South-North oriented flight legs were requested in Tra-Allgäu. We flew only the western leg, whose northern part was located over the Swäbische Alpen: the only area where cumuli developed (Fig 2). The Cessna started with an ascent up to 3 km, profiling the boundary layer and noting the location of the inversion at ~ 1.8 km, and then made our way down, flying alternating northward and southward along the leg at decreasing levels in the atmosphere: above the inversion (~ 1.875 km), below the

LCL (~1.4 km), and through the mixed-layer (~1.1 km, also the lowest allowed flight level). After this first set, we chose only the fly in the northernmost part, requesting permission to extend the leg another 5 miles, and traversed northward and southward at various levels, adding several levels near cloud tops (~2.5 km), through the cloud layer and cloud base (2 - 2.5 km) and the mixed-layer (Fig 4). The Falcon traversed the north-south leg > 10 times at an altitude of 8-9 km.

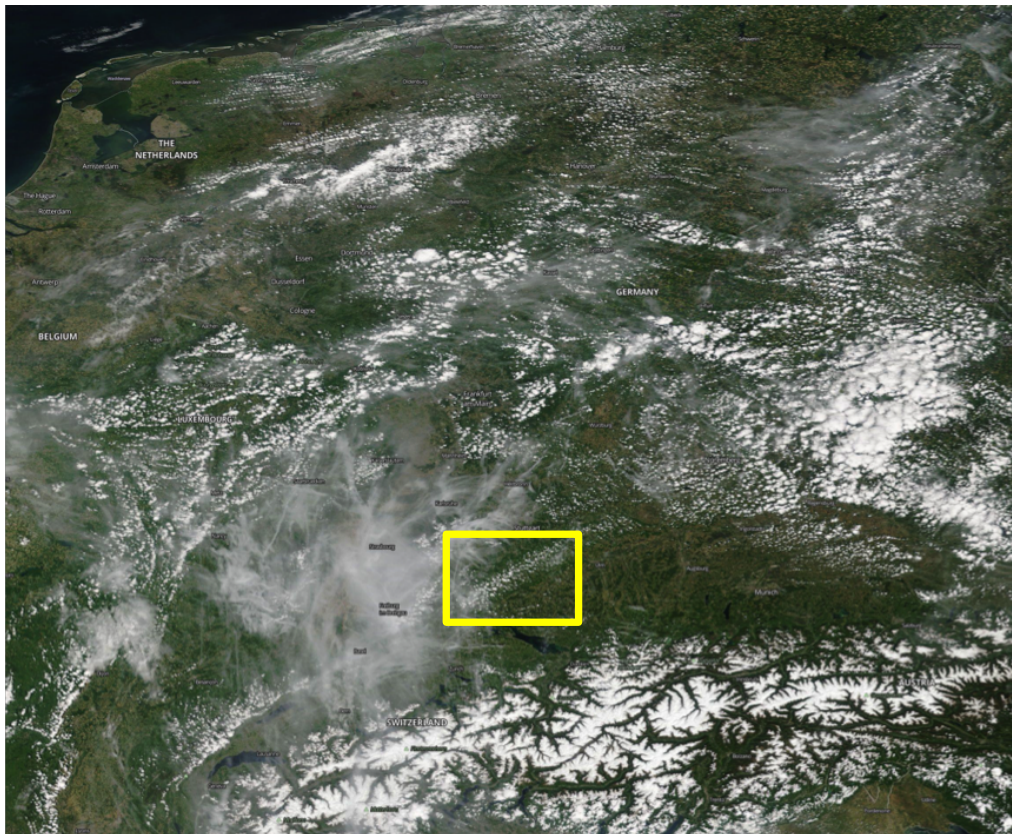


Figure 2: Visible image over Germany from Terra overpass (10:30 local time) and area of operations.

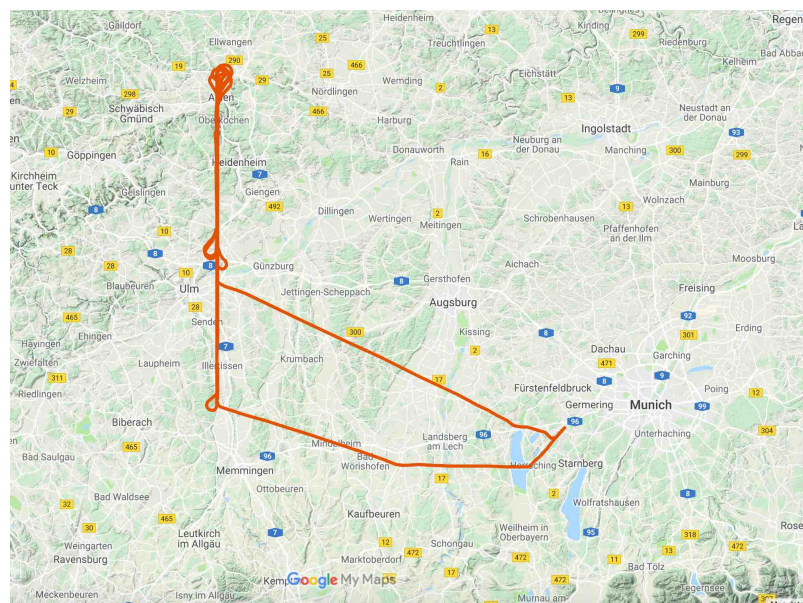


Figure 3: Flight track in Google Maps.

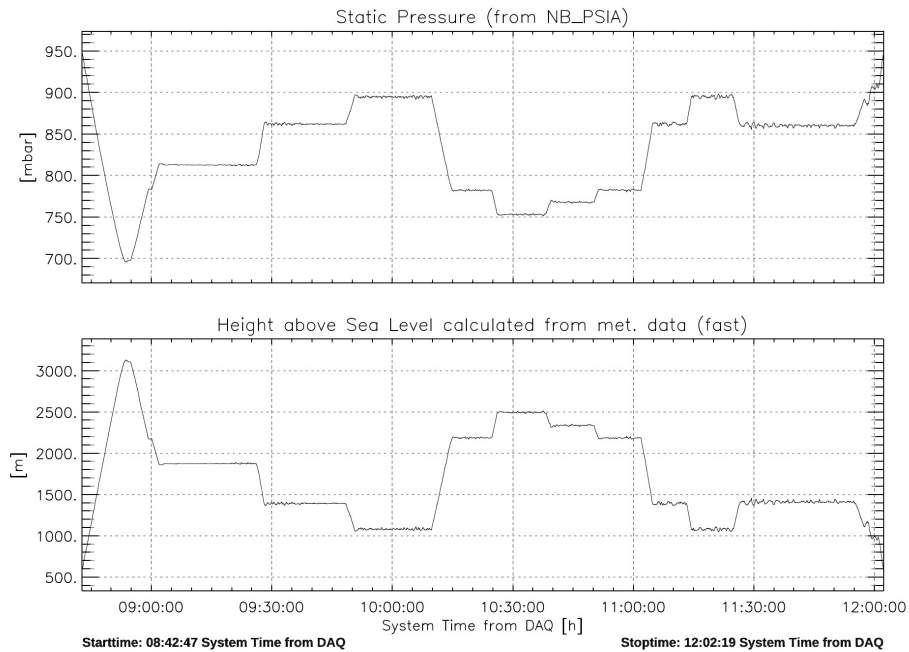


Figure 4: Vertical flight levels in pressure and height during the flight.

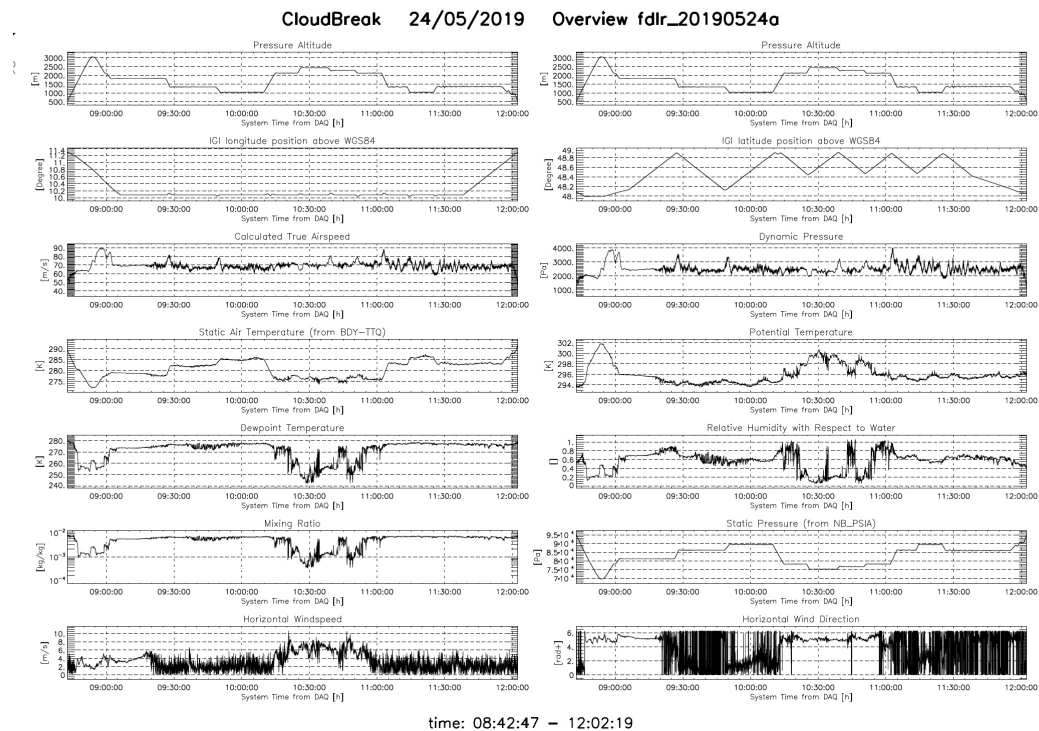


Figure 5: Quicklook of MetPod measurements of temperature, humidity and winds.

Flight notes:

(CEST)

10:42	Take off: clear skies, except for abundant cirrus/contrails.
10:50	Inversion located near 1.8 km, mostly visible in humidity, less so in temperature. Very dry air aloft. 180 degree wind turning across the inversion evident.
11:05	Start on western leg at 1.875 km (FL60), northward. Above the inversion, no notable turbulence.
11:20	First hits of turbulence and signs of condensation. Currently flying about 300 m below the LCL. Reaching the Swabische Alpen with developing clouds. Requesting extension of leg northward by 5 mi.
11:25	Return leg at 1.4 km. Clouds are disappearing.
11:48	Descending to 1.1 km and turn around to fly north.
12:02	Clouds overhead approaching.
12:09	Ascending to 2.2 km for return leg to south.
12:15	Flying through cloud base.
12:24	Ascend to 2.5 km and turn around to head north earlier, from now on traversing only the northern part of the leg.
12:33	Flying over clouds and through tops of the deepest cumuli over Alps.
12:35	Clouds getting shallower, with more clear spaces in between.
12:40	Descend to 2.3 km and return, flying through clouds.
12:50	Descend to 2.2 km (cloud base) and turn around to head north.
12:55	Flying just below or at cloud base.
13:00	Descend to 1.375 km and return leg to south.
13:11	Flying underneath some patchy cumulus humilis.
13:14	Descend to 1.1 km and head north again.
13:24	Ascend to 1.4 km and return leg south. Cumulus humilis still overhead.
13:37	Leave leg and fly back to Oberpfaffenhofen.