

## CloudBrake Flight 3 (CBRF3), Weser, June 4, 2019 (12:15-14:15 CEST)

### D-FDLR (Cessna):

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### D-CMET (Falcon):

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**Figure 1:**

Photographs illustrating the clouds measured on CBRD3. Top photo: flying near cloud tops along the western leg. Bottom from left to right: Flying through the cloud layer, top view on cloud deck whilst arriving in Tra Weser, and flying below cloud base and near a wind farm along the eastern leg.

### Weather

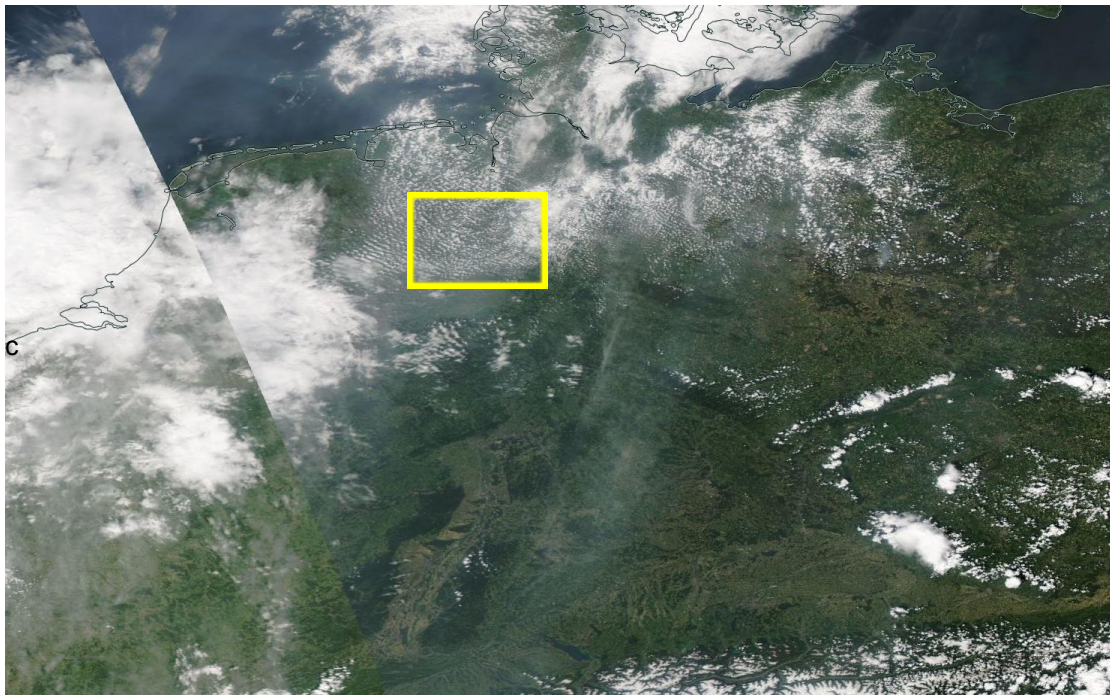
#### conditions and clouds:

This flight measured an extended beautiful field of shallow cumulus clouds that developed behind a cold front over northwestern Germany. Clouds had bases near 1200 m and very diverse cloud top heights, with maximum tops near 2 km. Very cloudy patches alternated with cloud free "holes", especially as the clouds were getting a bit deeper towards the northern parts of the leg. Near- surface winds were weak and coming from the south, turning to strong southwesterly winds above the cloud layer. Decent shear was present across the cloud layer (clouds were weakly sheared), and wind speeds measured inside clouds were up to 4-5 m/s slower than

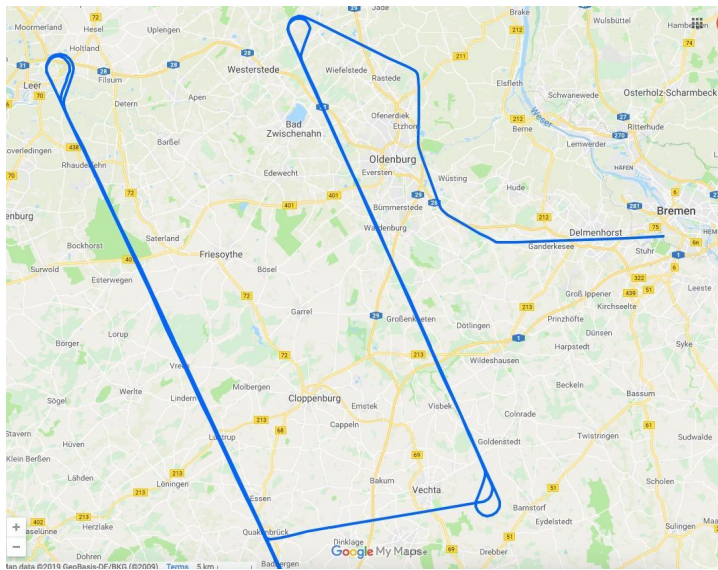
in the surrounding clear sky air. Very little upper level cloud was present, so that both lidars aboard the Falcon had an excellent view of the underlying wind field.

### **Flight pattern:**

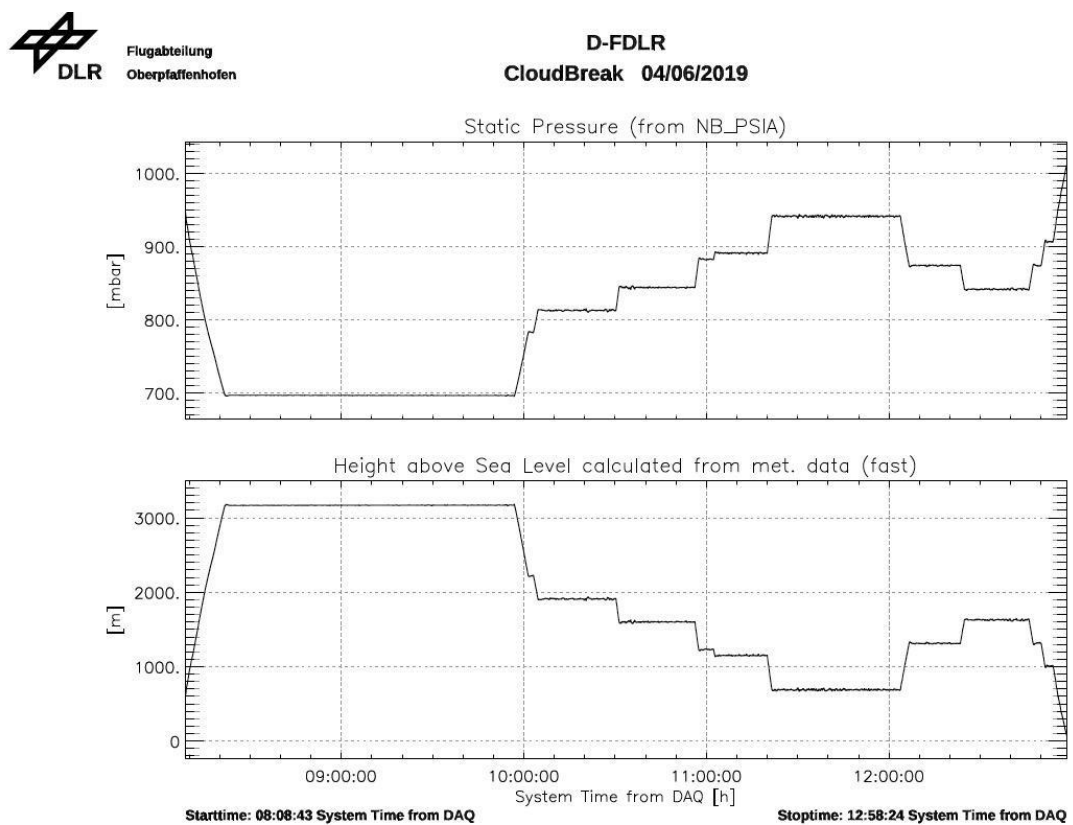
The flight started with a long transfer from Oberpfaffenhofen to Tra Weser. In the area of operations a western and eastern leg were flown that were both oriented somewhat perpendicular to the prevailing southwesterly winds: from southeast to northwest. Each leg was flown at 3 - 4 different height levels (taking ~ 20 minutes each), corresponding to the sub-cloud layer (~ 600 m), the cloud base (1150 - 1250 m), the cloud layer (1500 m) and near cloud tops (1800 m). The Falcon flew both legs multiple times at a constant level of 7.3 km.



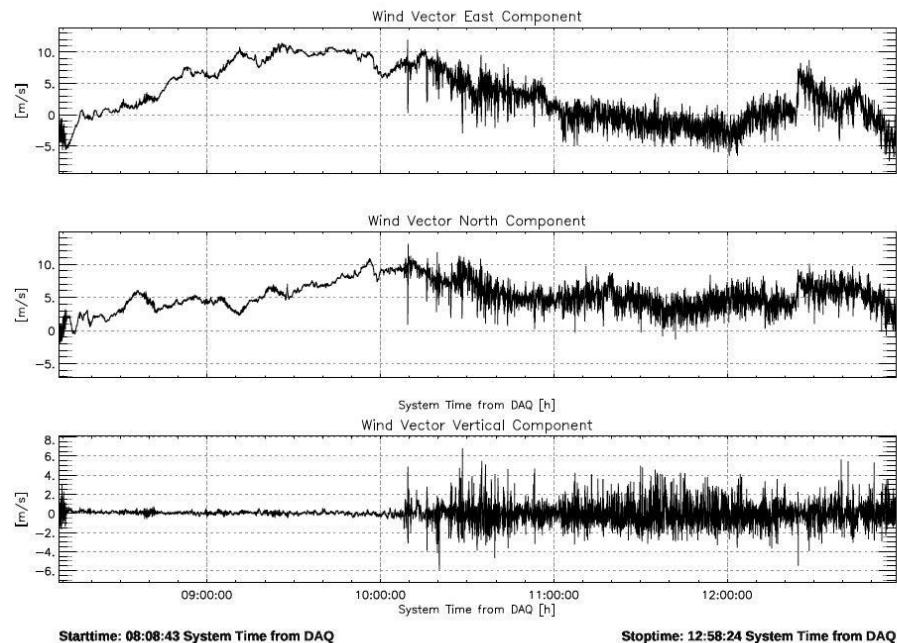
**Figure 2:** Visible image over Germany from Aqua overpass (13:30 local time) and area of operations.



**Figure 4:** Flight track in Tra Weser in Google Maps.



**Figure 5:** Vertical flight levels in pressure and height during the flight. First two hours are the transfer from Oberpfaffenhofen to Tra Weser.



**Figure 5:** Quicklook of MetPod measurements of horizontal and vertical wind.

### Flight notes:

(CEST)

10:00	Take off. Clear skies.
11:17	First cumuli developing on the transfer to Tra Weser.
11:40	A seemingly endless shallow cloud deck present, with also some patches of stratocumulus between shallow cumulus.
12:04	Flying near cloud tops at 1800 m, the field looks great with very diverse cloud tops.
12:08	Starting transecting the western leg at 1800m, hitting first cloud tops and turbulence at 12:10.
12:16	Passage through a very deep clouds.
12:19	Many cloud tops are passed through.
12:23	Note wind speeds of 8-9 m/s in clouds, but 12 - 13 m/s outside of clouds.
12:32	Return leg southward at 1500 m, through the cloud layer.
12:45	Clouds are a bit shallower at the southern part of the leg.
12:58	Turning north again with a leg at 1150 m.
11:02	Descending another 100 m to 1050m to better target cloud base.
11:22	Return leg southward at 600 m to fly through the sub-cloud layer.
11:40	Transfer to eastern leg
11:46	Start of eastern leg at 600 m. Cloud bases seem higher here.
12:03	Return leg southward at 1250 m (cloud base).
12:21	Note that cloud base is lower than 1250 m at this part of the leg.
12:26	Leg northward at 1540 m, near cloud tops.
12:40	End of leg, head to Bremen.