

EFB Weather Display

EASA Workshop "Weather information provided to pilots"
28-29/10/2015

First Officer Daniel Wolf

Head of Project Global Weather Hazards, Lufthansa



Weather Hazards

Accidents & incidents related to bad weather in-flight continue to happen

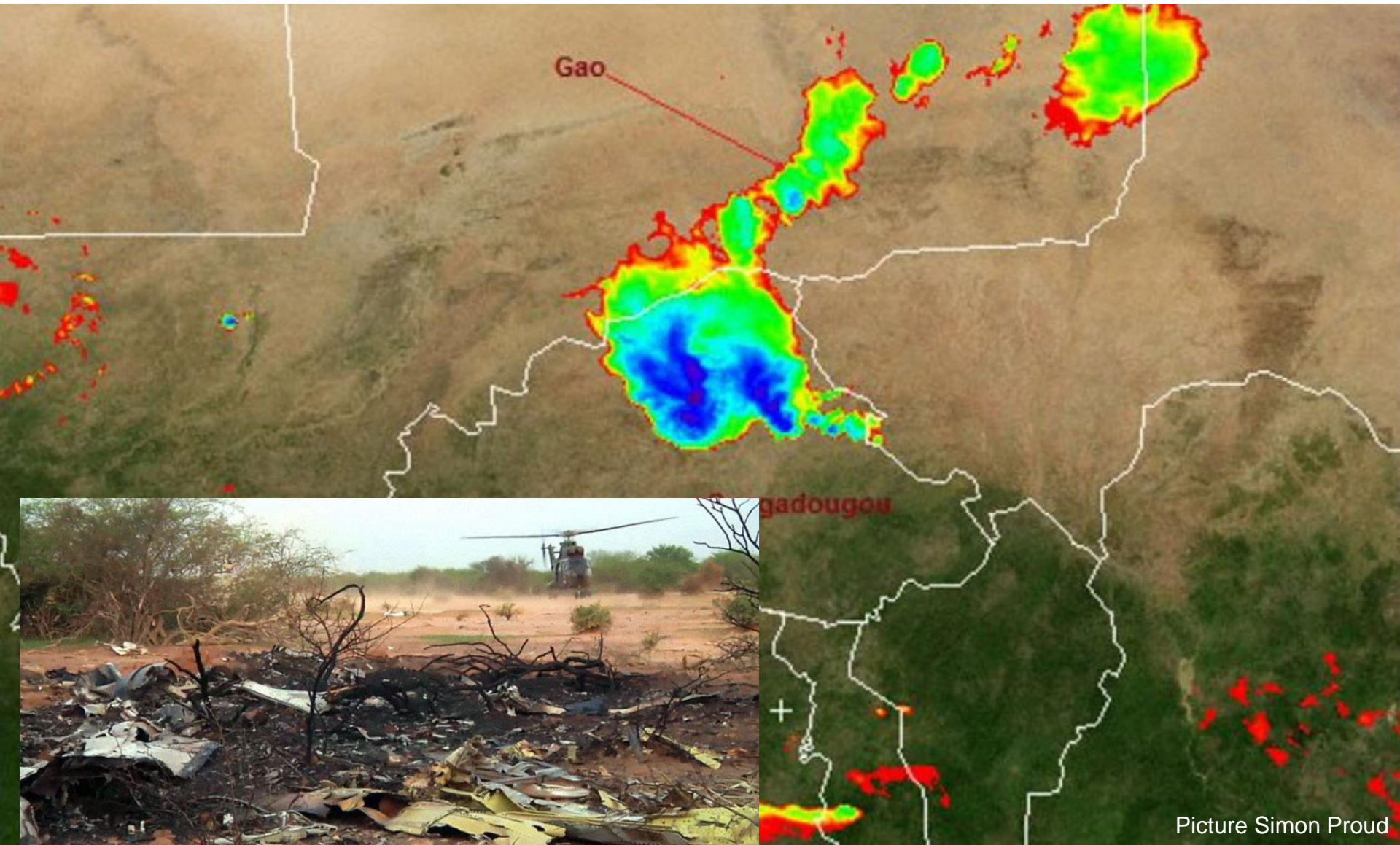
2014: A McDonnell Douglas MD-83 performing a flight from Ouagadougou (Burkina Faso) to Algiers (Algeria), was en-route over Mali **near Gao** about 50 minutes into the flight when contact with the aircraft was lost.

The aircraft was located in the evening.
There were no survivors.

Weather researcher Simon Proud of MIT reported the tops of the **clouds** were **above FL400** in that region **around Gao**, peaking up to FL500. In the green areas there could have been limited updrafts, in the blue/purple areas there could have been strong updrafts. Conditions may have been susceptible for ice crystal icing.

Weather Hazards

Accidents & incidents related to bad weather in-flight continue to happen



Picture Simon Proud

Picture AFP

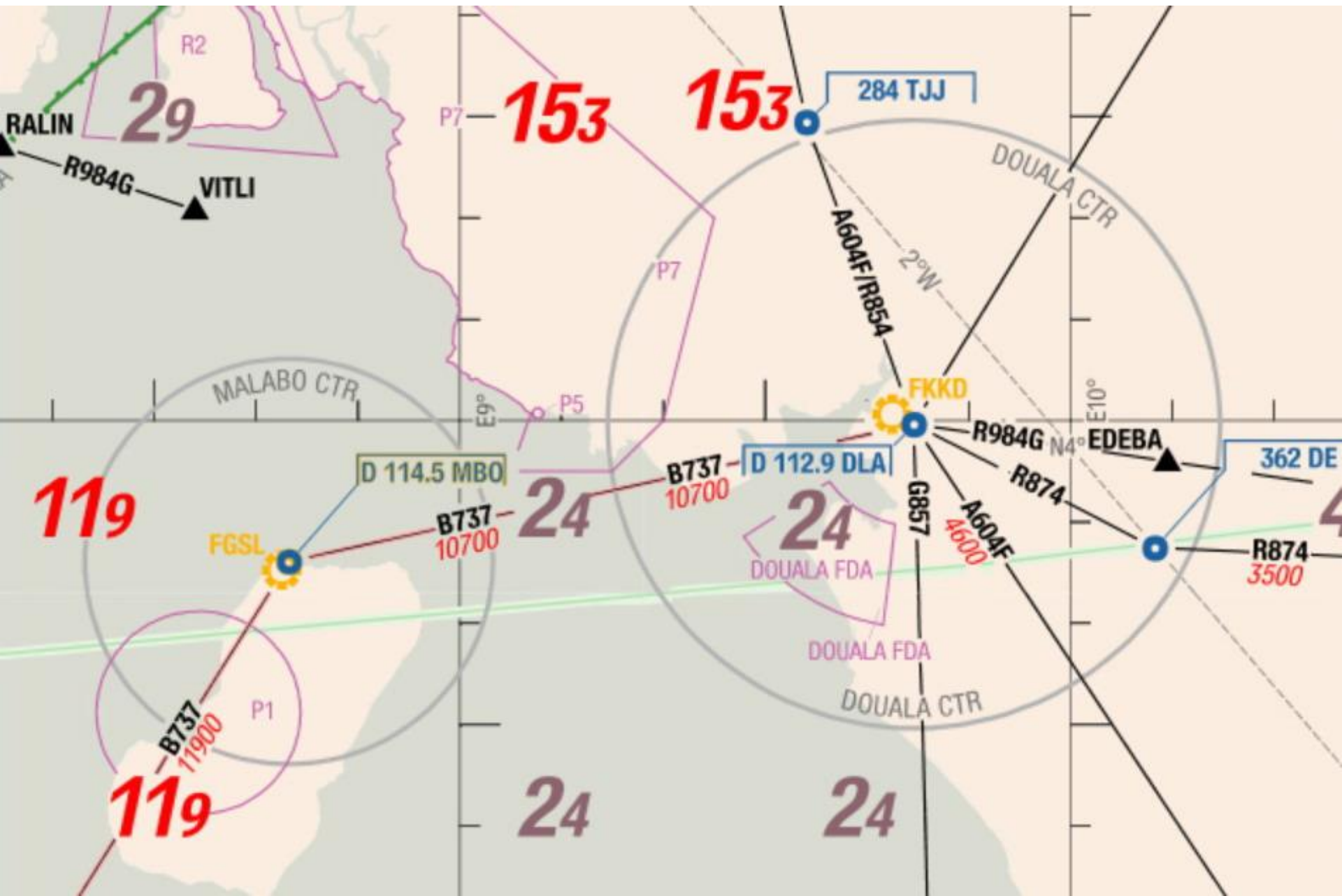
Weather Hazards

Accidents & incidents related to bad weather in-flight continue to happen

MAY-2015: A Boeing 777 performing a flight from Malabo (Equatorial Guinea) to Douala (Cameroon) was en-route to Douala maintaining FL090 when the crew requested and was cleared to **deviate north of the assigned route due to thunderstorms**. Later, while turning right towards Douala the EGPWS of the aircraft issued a terrain warning and called "PULL UP!" which the crew complied with climbing the aircraft to FL130, where the EGPWS stopped the warnings. The aircraft subsequently continued for a safe landing in Douala

EFB Weather Display

Accidents & incidents related to bad weather in-flight continue to happen



Issues, from a pilot's perspective...

- 1. Weather Information Services**
- 2. Wx-Radar Limitations**
- 3. No Integrated Flight Weather Display**

Issues, from a pilot's perspective...

1. Weather Information Services

- No common view of weather situation → difficult collaborative decision making (CDM)
- Pilots are using different Weather Apps on their own devices to get the real picture.
- Accurate and Up-to-date Nowcasts vs. ICAO Annex 3 Forecasts
- Online today vs. Offline in the 50'

Issues, from a pilot's perspective...

1. Weather Information Services

- Continuous Mission Support vs. WX Briefing only once before Flight
- Updated vs. outdated
- Cognitive processing speed Grafical vs. Textual in time critical situations

Quick! You are 5 minutes above minimum diversion fuel: Where do you want to land? Do you get the picture?

Metars Miami:

KMIA 151923Z COR 34012G25KT 1SM +TSRA BR FEW007 SCT019CB OVC031 23/22 A2998 RMKAO2 PK WND 29030/1910 WSHFT 1903 OCNL LTGICCG OHF TS OHF MOV NE P0005 T02330217
KMIA 151911Z 31018G30KT 270V340 7SM -TSRA SCT019CB OVC033 25/22 A2997 RMK AO2 PK WND 29030/1910 OCNL LTGICCG OHF-W TS OHF-W MOV NE P0000 T02500222
KMIA 151853Z 00000KT 7SM -TSRA FEW005 BKN012CB BKN250 26/23 A2998 RMK TORNADO B29 3 MILES WEST MOV NE TORNADO E37 AO2 RAE28B34 SLP152 OCNL LTGIC OHF-SW-N TS OHF-SW-N MOV NE P0019 T02610233
KMIA 151839Z VRB06KT 1/2SM TSRA VV010 26/23 A2997 RMK TORNADO B29 3 MILES WEST MOV NE TORNADO E37 AO2 RAE28B34 OCNL LTGIC OHF TS OHF MOV NE P0019 T02610233
KMIA 151831Z VRB06KT 7SM +FC TS SCT015CB BKN035 BKN080 BKN300 26/24 A2998 RMK TORNADO B29 3 MILES WEST MOV NE AO2 RAE28 OCNL LTGIC W-NW TS W-NW MOV NE P0008 T02
KMIA 151753Z 09005KT 7SM -TSRA SCT012CB BKN035 BKN070 BKN300 25/24 A2998 RMK AO2 SLP152 OCNL LTGICCG W-NW TS W-NW MOV NE P0065 60114 T02500239 10283 20239 58011
KMIA 151749Z 07003KT 7SM -TSRA SCT012CB BKN035 BKN070 BKN300 24/23 A2999 RMK AO2 OCNL LTGICCG W-NW TS W-NW MOV NE P0065
KMIA 151732Z 14009G17KT 3SM +TSRA BR FEW007 BKN014CB OVC037 25/23 A3000 RMK AO2OCNL LTGIC OHF TS OHF MOV NE P0039 T02500233
KMIA 151723Z 17011G18KT 1/2SM +TSRA FG FEW007 OVC014CB 26/24 A3000 RMK AO2 OCNLLTGIC OHF TS OHF MOV NE P0025 T02560239
KMIA 151653Z 13009KT 6SM TSRA BR FEW007 BKN015CB OVC050 26/24 A3000 RMK AO2 RAB23 TSB26 SLP158 VIS SW 2 OCNL LTGIC VC SW-W TS VC SW-W MOV NE CB OHF-S MOV NE P0009 T02610244
KMIA 151626Z 18012G19KT 7SM -TSRA SCT009 BKN015CB BKN080 OVC300 26/24 A3001 RMKAO2 RAB23 TSB26 OCNL LTGIC S-SW TS S-SW MOV N P0000 T02610239
KMIA 151553Z 16010KT 10SM SCT013CB BKN130 BKN300 27/24 A3001 RMK AO2 LTG DSNT N AND W RAE32 SLP161 TSE21 CB NE-SE-SW MOV N P0020 T02670244

Metars Orlando:

KMCO 152011Z COR 23009KT 10SM -RA FEW025CB SCT050 BKN070 BKN150 27/24 A2989 RMKAO2 RAB01 TSE10 TS MOV NE CB NW-N MOV NE CB DSNT NE-SE-S MOV NE P0000 T02720244
KMCO 151953Z 26007KT 10SM TS FEW015 SCT033CB BKN060 OVC150 26/23 A2990 RMK AO2 PK WND 28026/1901 WSHFT 1840 RAE44 SLP125 FRQ LTGICCC NE-SE TS NE-SE MOV NE CB DSNT NW MOV NE P0059 T02560233
KMCO 151909Z 34006G26KT 4SM R35L/1600VP6000FT -TSRA BKN018 BKN035CB OVC090 23/20 A2991 RMK AO2 PK WND 28026/1901 WSHFT 1840 CONS LTGICCCCG N-E-SE TS N-E-SE MOV
KMCO 151917Z 15008KT 7SM R35L/1600VP6000FT -TSRA SCT024 BKN037CB BKN090 OVC200 24/21 A2993 RMK AO2 PK WND 28026/1901 WSHFT 1840 CONS LTGICCCCG NE-SE TS NE-SE MO
KMCO 151859Z 27021G26KT 1SM R35L/2000VP6000FT TSRA BR SCT024CB BKN038 OVC050 24/23 A2993 RMK AO2 PK WND 26026/1858 WSHFT 1840 PRESRR CONS LTGICCCCG OHF AND ALQD
KMCO 151853Z 30018KT 3SM +TSRA SCT030CB BKN050 OVC220 25/22 A2990 RMK AO2 WSHFT 1839 RAB39 TSB17 SLP124 FRQ LTGICCCCG N TS N MOV NE CB OHF-S-W MOV NE P0018 T02500222
KMCO 151818Z 16010KT 10SM TS FEW027CB SCT048 BKN090 BKN250 30/23 A2990 RMK AO2 TSB17 OCNL LTGICCG NW TS NW MOV NE T03000228
KMCO 151753Z 15010KT 10SM FEW016 SCT035CB BKN090 BKN250 29/22 A2990 RMK AO2 SLP125 CB SW-NW MOV NE T02940222 10317 20239 58025

Metars Fort Lauderdale:

KFLL 151953Z 18010KT 1/2SM R10L/3000VP6000FT +TSRA FG VV017 24/24 A2998 RMK AO2 PK WND 10030/1928 WSHFT 1929 SLP151 CON LTGICCG OHF-ALQDS TS OHF-ALQDS MOV NE P0230 T02440244 \$
KFLL 151944Z 19011KT 1/2SM R10L/3000VP6000FT +TSRA FG VV017 24/24 A2999 RMK AO2PK WND 10030/1928 WSHFT 1929 CON LTGICCG OHF-ALQDS TS OHF-ALQDS MOV NE P0205 T02
KFLL 151936Z 18015G30KT 1/2SM R10L/2000V4000FT +TSRA FG OVC014 24/24 A2999 RMK AO2 PK WND 10030/1928 CON LTGICCG OHF-ALQDS TS OHF-ALQDS MOV NE P0189 T02440244 \$
KFLL 151853Z 14012KT 1 1/2SM R10L/4000VP6000FT +TSRA BR BKN015 BKN065 BKN100 25/24 A2999 RMK AO2 TSB11 SLP155 OCNL LTGCG S TS S MOV N P0053 T02500244
KFLL 151812Z 19008G17KT 1 1/4SM R10L/3500VP6000FT +TSRA BR BKN015 BKN065 BKN10026/24 A2999 RMK AO2 TSB11 OCNL LTGCG S TS S MOV N P0008 T02560244
KFLL 151810Z 19012G17KT 1 1/4SM R10L/3500VP6000FT -RA BR BKN015 BKN065 BKN100 26/24 A2999 RMK AO2 P0007 T02560244

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Issues, from a pilot's perspective...

2. Wx-Radar Limitations

- Onboard Wx-Radar
 - Range is limited (100-130NM, 10-15Min.)
 - Shadowing (Blind Alleys, Dipsy-Doodle)
 - Beam Spread (Wx left, right and behind me?)
 - Trust: Visual Cues differ from represented echoes!

Issues, from a pilot's perspective...

3. No Integrated Flight Weather Display

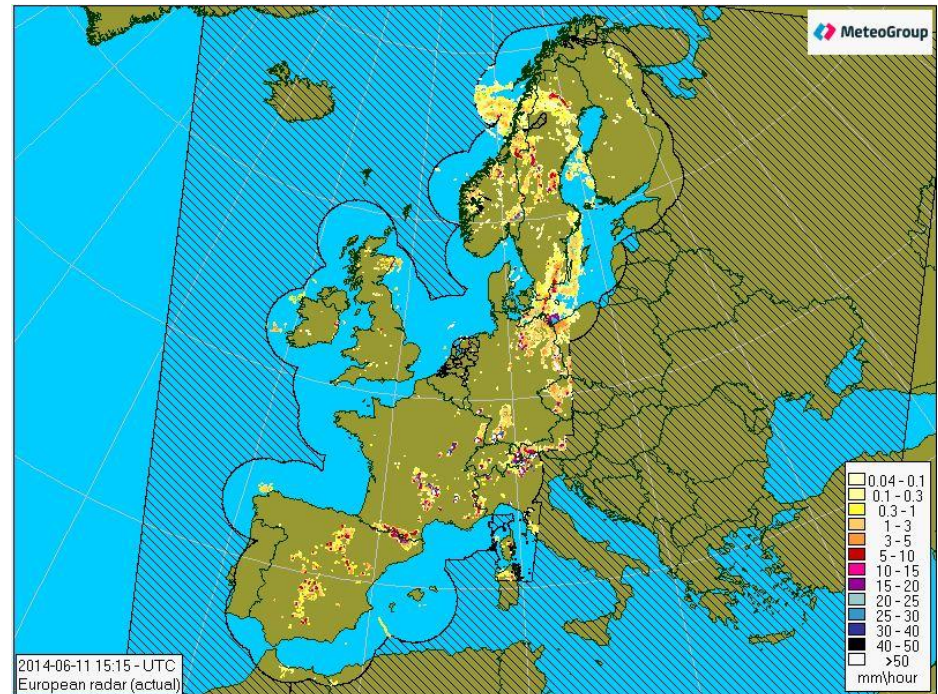
- Briefing Package – Navigation Display – EFB eRoute Manual
- Different presentation, „age“ and validity
- Colored Radar and Satellite images without the flight route
- Nav Display shows weather radar OR terrain data, but cannot show both simultaneously
- Nav Display doesn't show Minimum Grid Altitudes
- eRM Enroute chart on EFB today doesn't show thunderstorms

Issues, from a pilot's perspective...

Most airlines give their pilots satellite pictures and RADAR charts:

Disadvantages are:

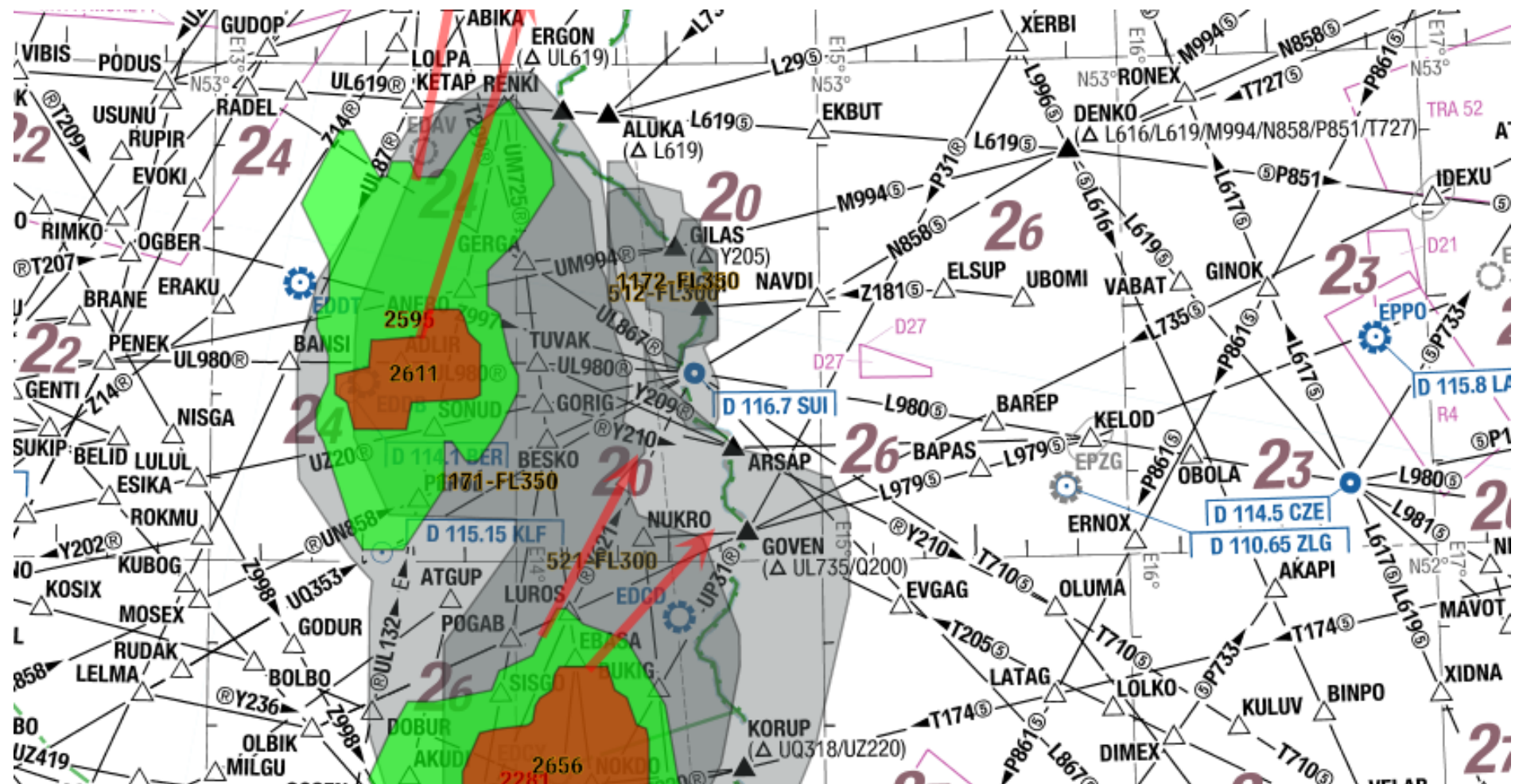
- The charts show the actual weather at the time of flight briefing, but what is needed is the weather during flight
- The charts don't show the route and are not tailored to the routing
- The relevance of the chart content is questionable (e.g. precipitation)



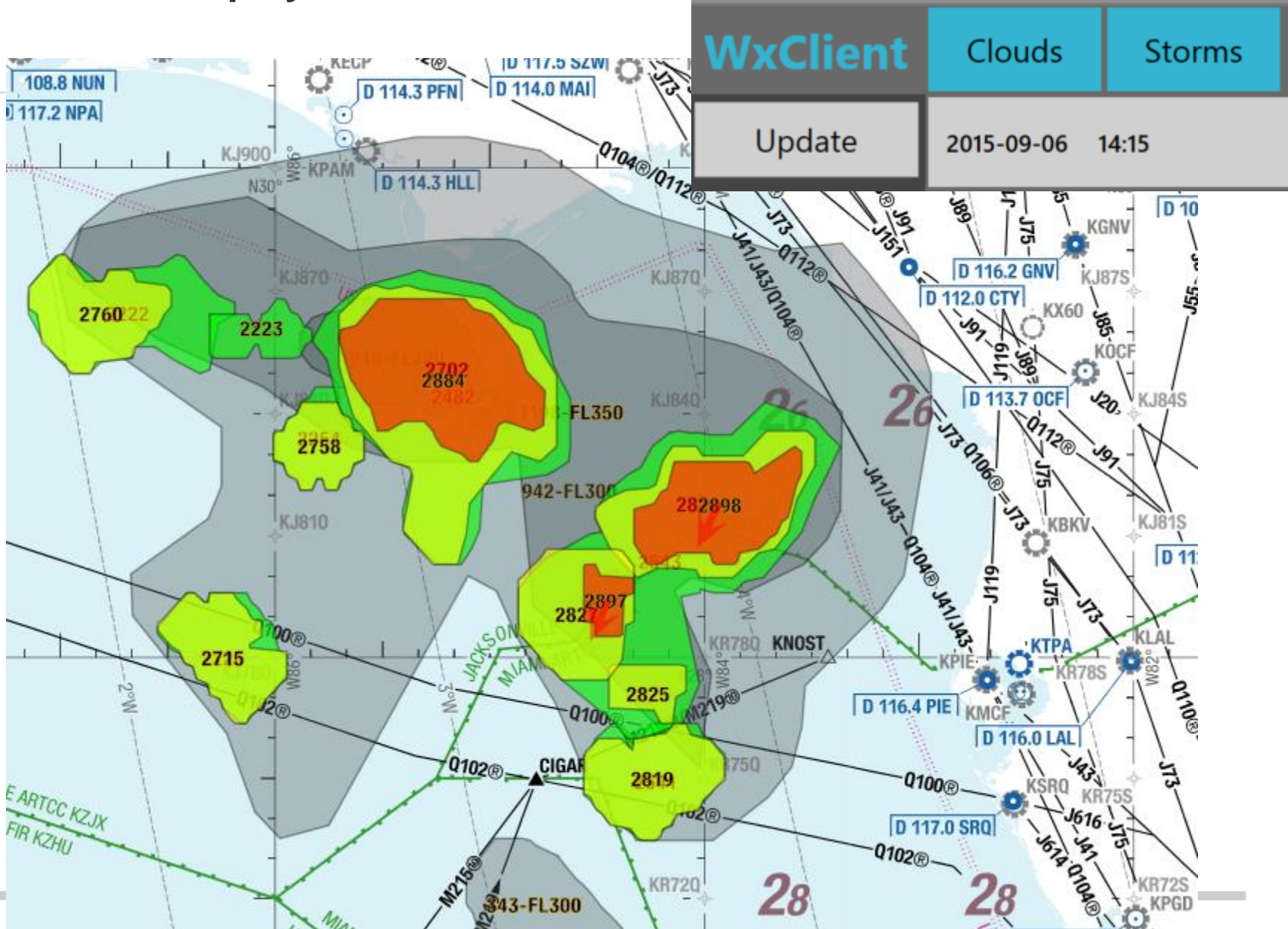
What Pilots need

1. Simplified Weather Display without indication of nature's complexity
2. No Fly Zones (red), Caution Zones (yellow), Advisory Area (green)
3. All hazards / weather phenomena available/selectable on one display
4. Mission Related Weather Display (in space and time)
5. New Procedures considering
 - Collaborative Decision Making (Aircraft, Operations, ATM, Airports)
 - Air-Ground-Communication performance (latency, outages, etc.)
 - Quality of presented weather data
 - Meteorological Limitations

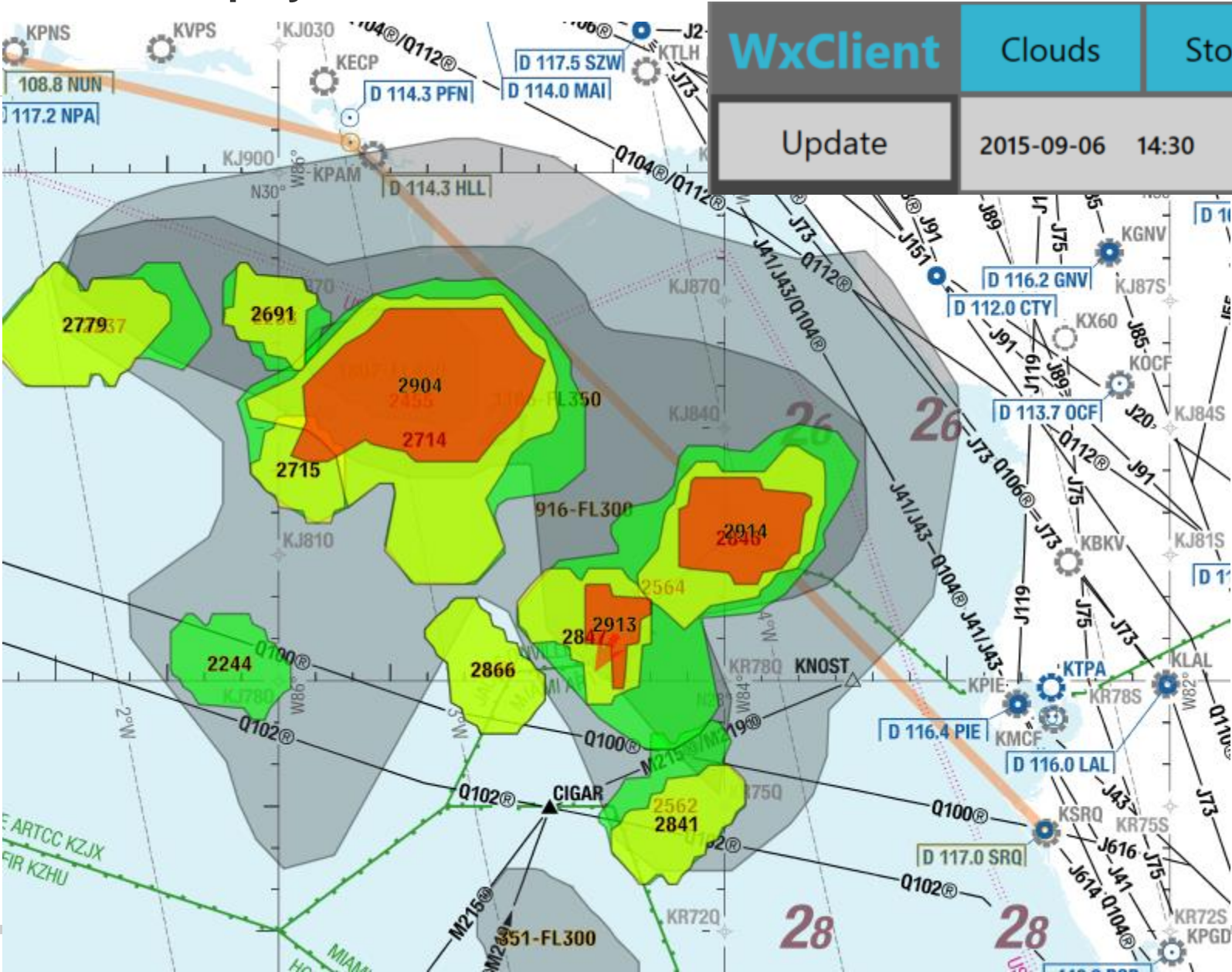
EFB Weather Display – Storm over Northern Germany



EFB Weather Display - Storm west of Florida



EFB Weather Display - Storm west of Florida

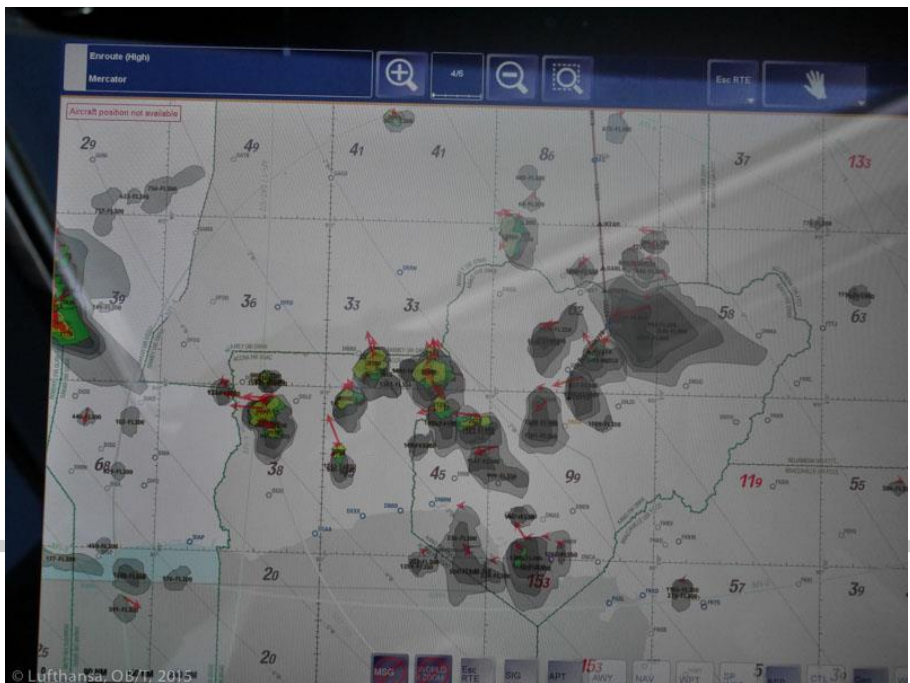


WxCli^{nt}

CloudsStorms

Update

2015-09-06 14:30





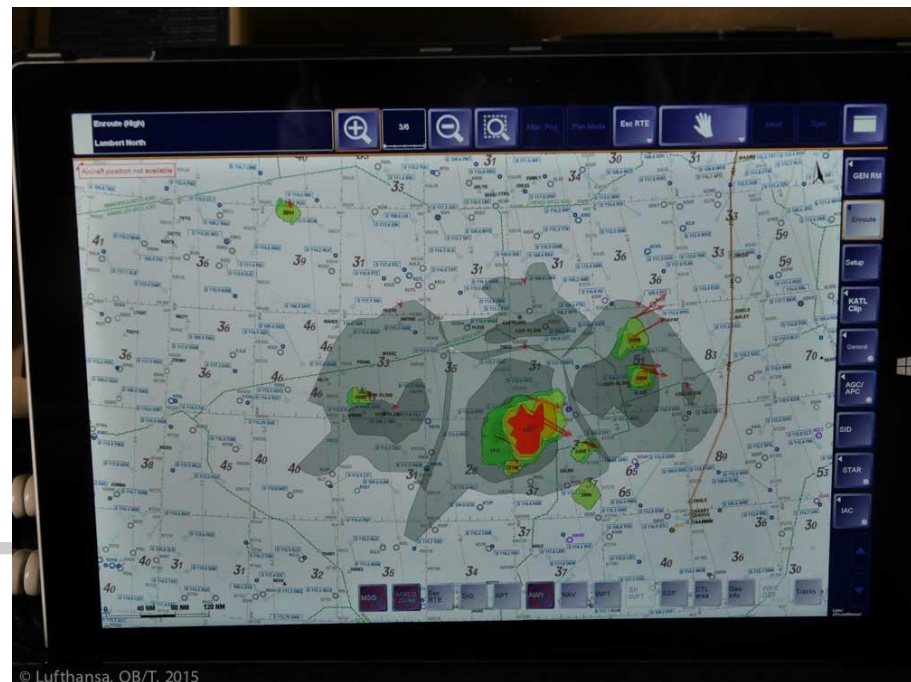
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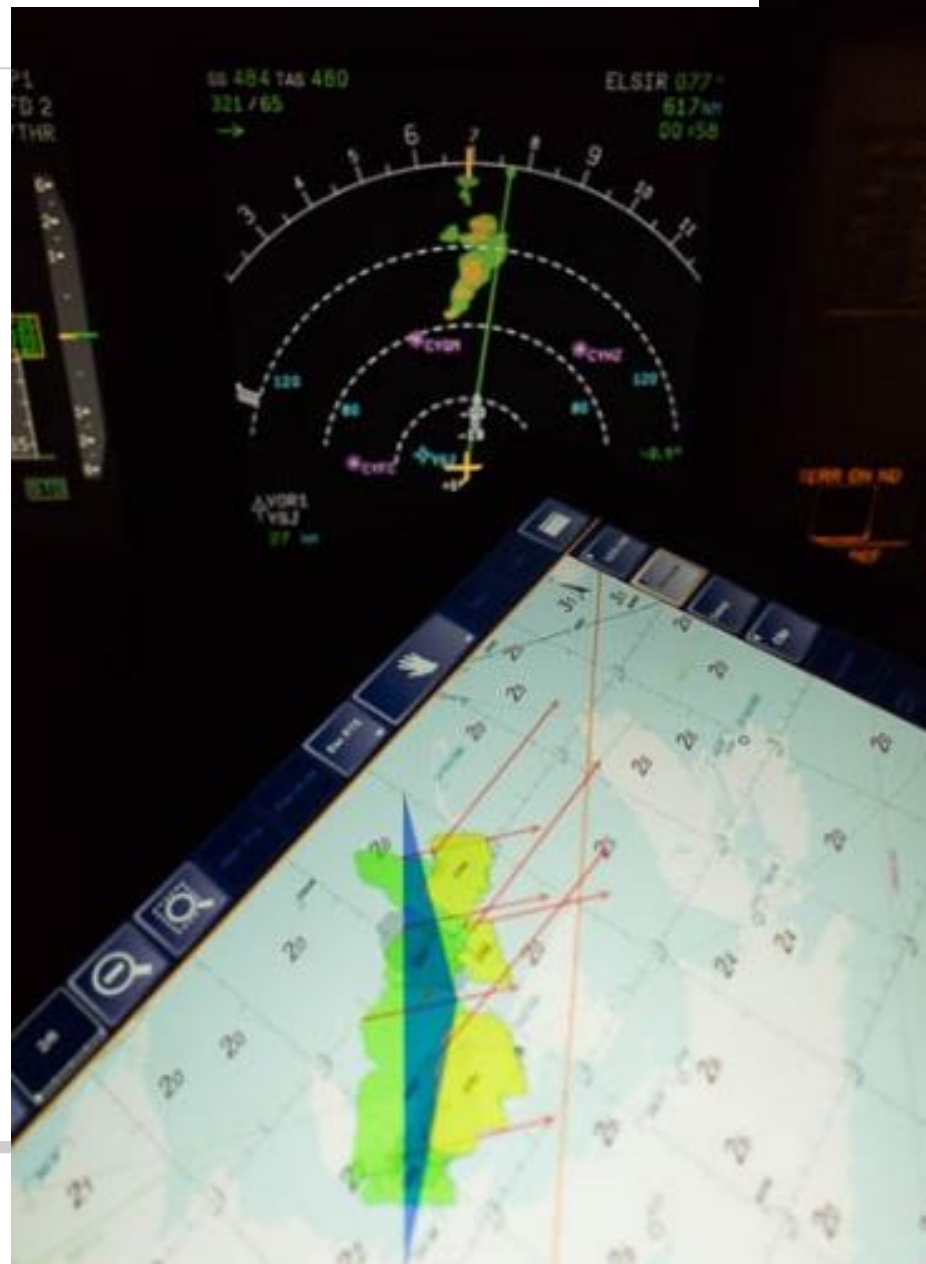


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SIGMET J2 VALID 312305/010305 CWUL – CZQM MONCTON FIR FRQ TS OBS WTN 10 NM OF
LINE N4609 W06434 – N4640 W06305 – N4736 W06200 TOP FL360 MOV SE 30KT NC

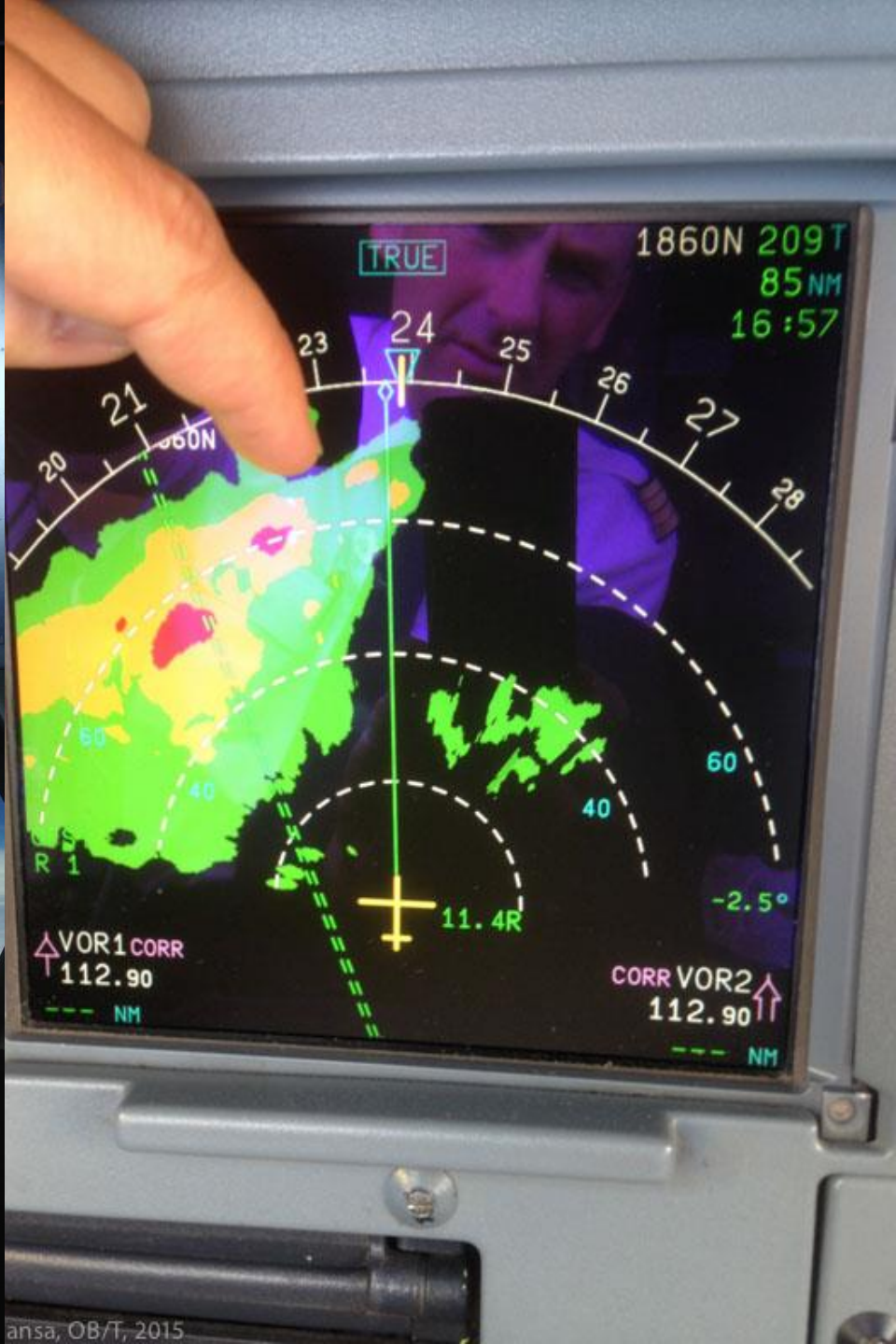
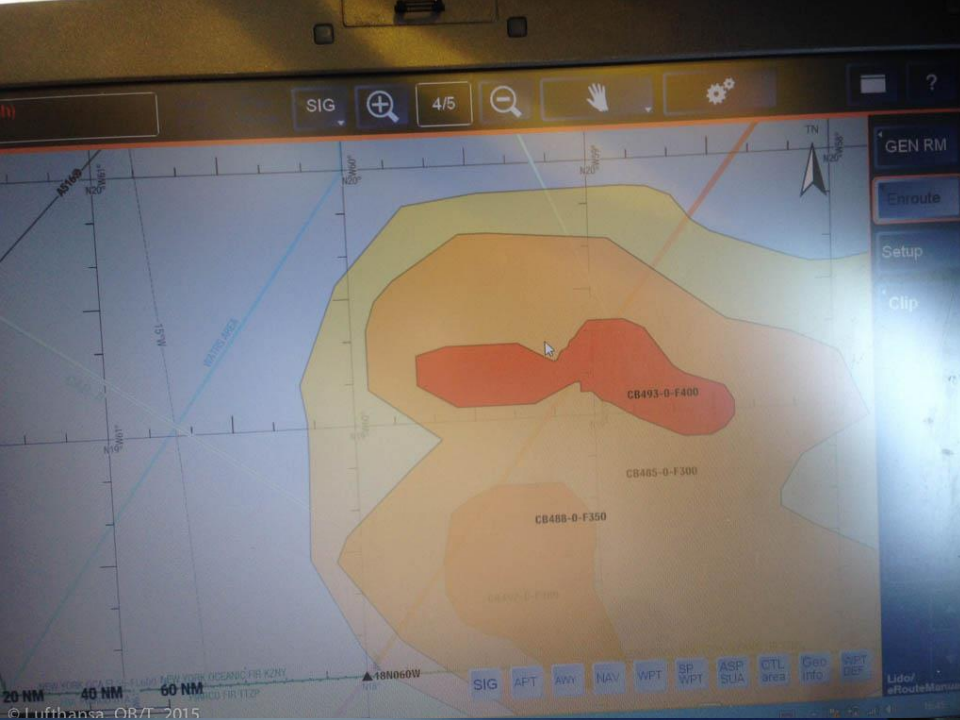




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Questions?

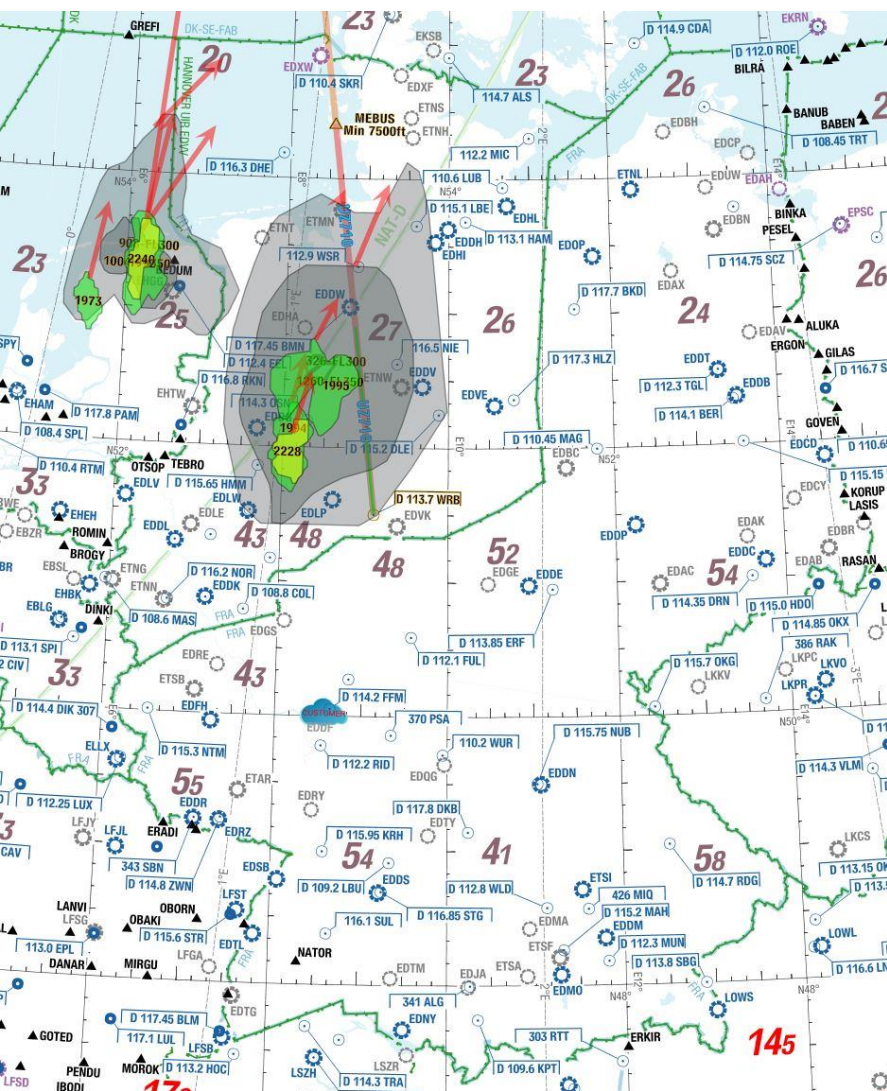
andreas.ritter@dlh.de

daniel.wolf@dlh.de

Storms over northern Germany

Andreas Ritter, OB/T, Lufthansa

Based on data from BCI/NCAR/meteoStar & DWD



This presentation compares satellite generated weather polygons with ground based weather radar and METARs

05-JUL-2015 was the 4th day of a heat wave with temperatures above 40 degrees celsius in some parts of Germany. The meteorologists promised heavy thunderstorms over parts of Germany. However, the storms appeared only in the north of Germany and bypassed most major airports.

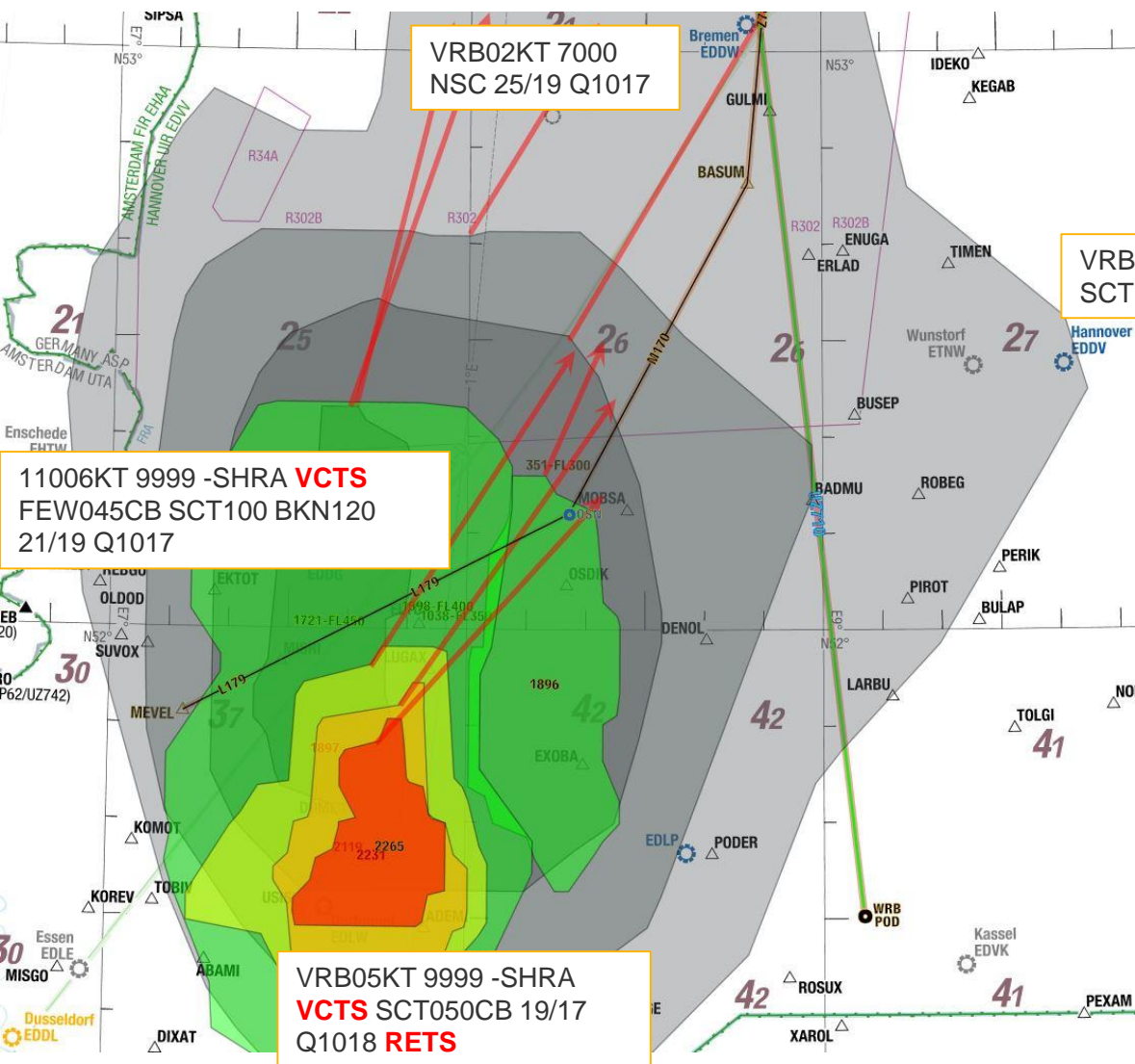
Bremen

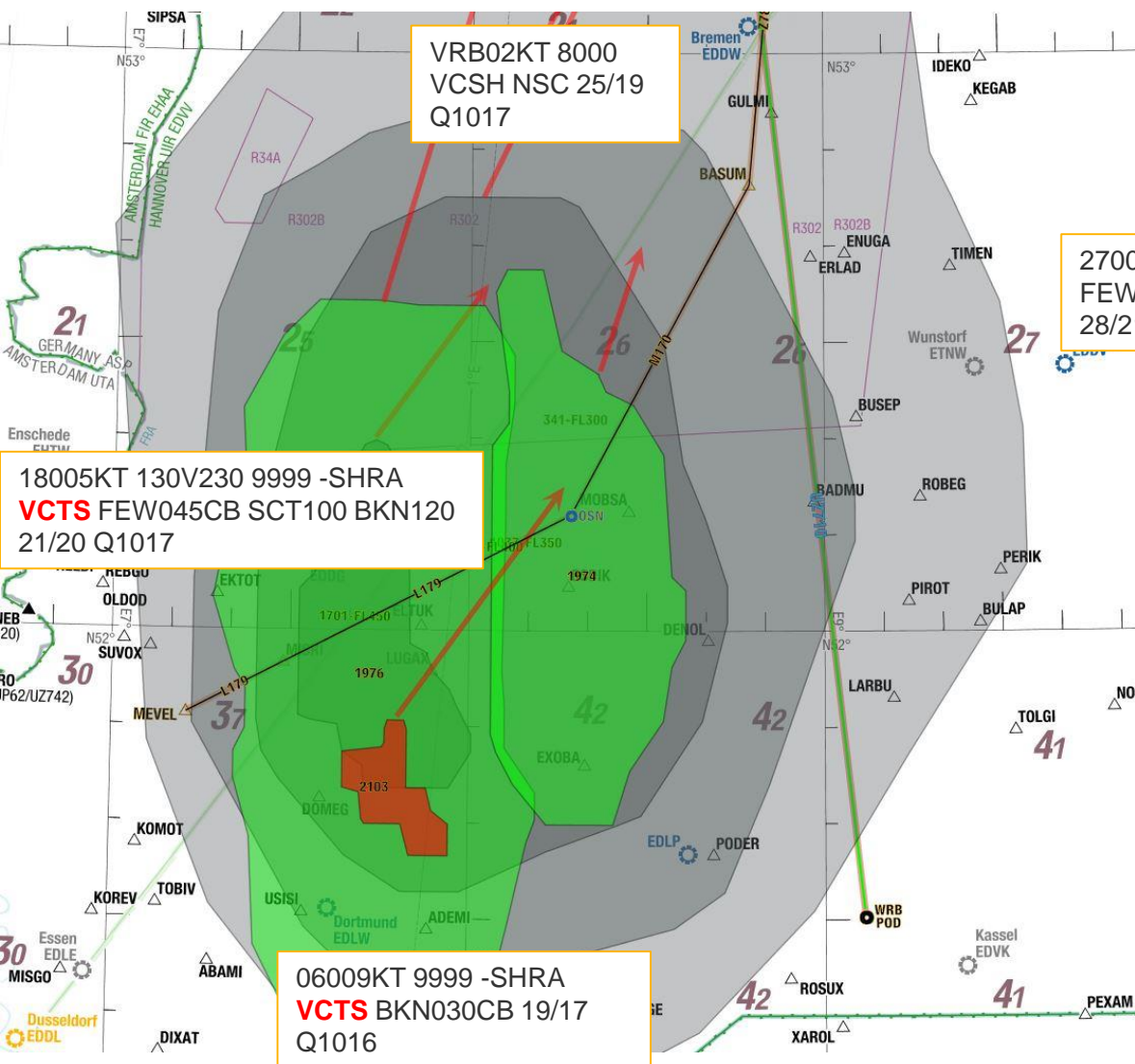
**05-JUL-
2015**

Hannover

**Münster
/Osnabrück**

Dortmund





VRB02KT 8000 -SHRA
SCT045 BKN120 BKN300
25/20 Q1017

**SAT/RADAR=10:15
UTC,
METAR=10:20**

30005KT 260V330 9999
FEW030 SCT070 BKN120
28/21 Q1017

11004KT 9999 **VCTS** -SHRA
FEW045CB SCT100 BKN120
21/19 Q1016

11009KT 080V140 9999
VCTS BKN095CB 21/17
Q1016

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VRB02KT 8000 SCT045
BKN120 BKN300 25/20
Q1017

**SAT/RADAR=11:00
UTC,
METAR=10:50**

27011KT 9999 FEW030
SCT070 BKN120 26/21
Q1018

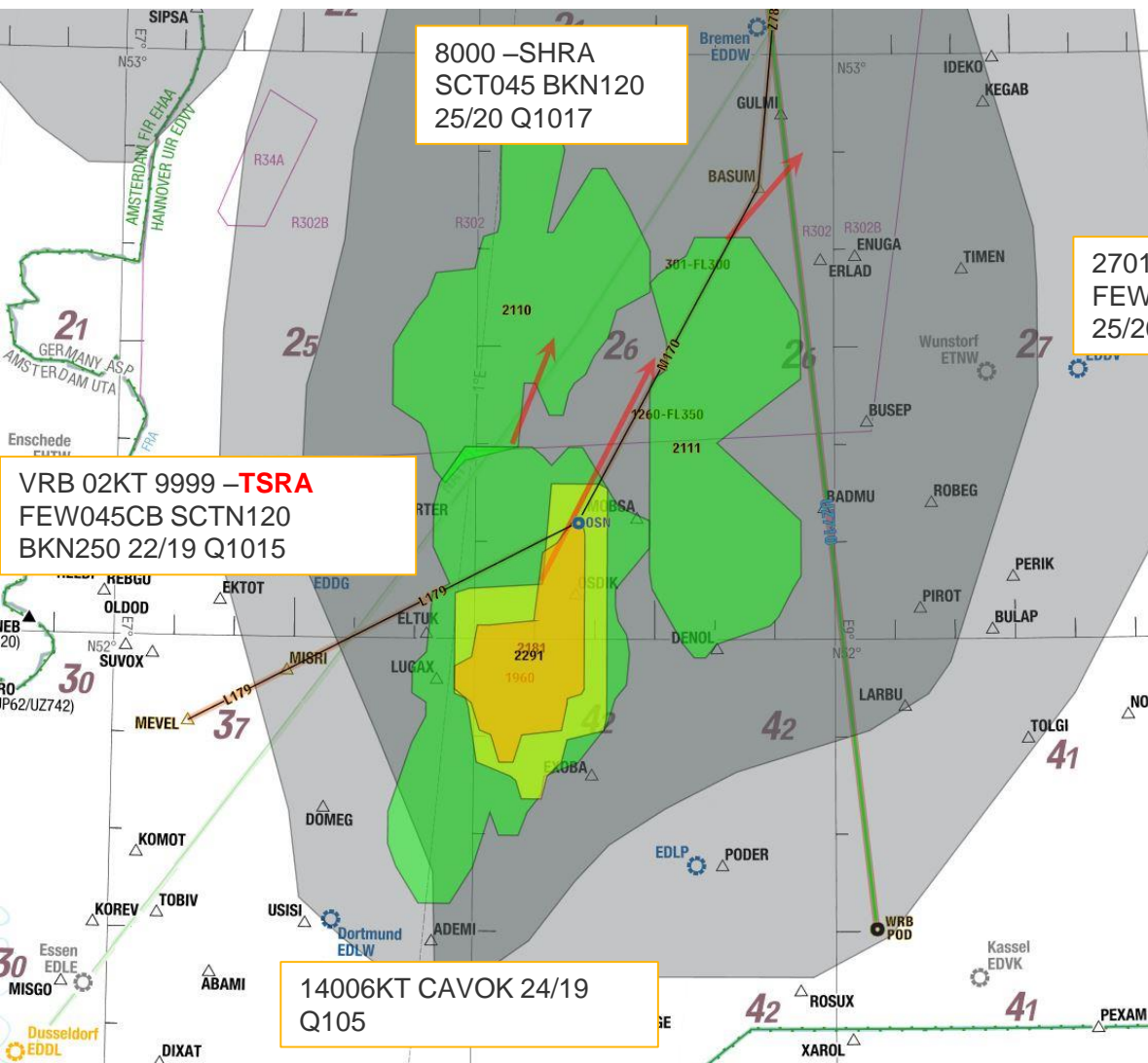
10005KT 9999 **VCTS**
FEW045CB SCT120 BKN250
21/19 Q1015

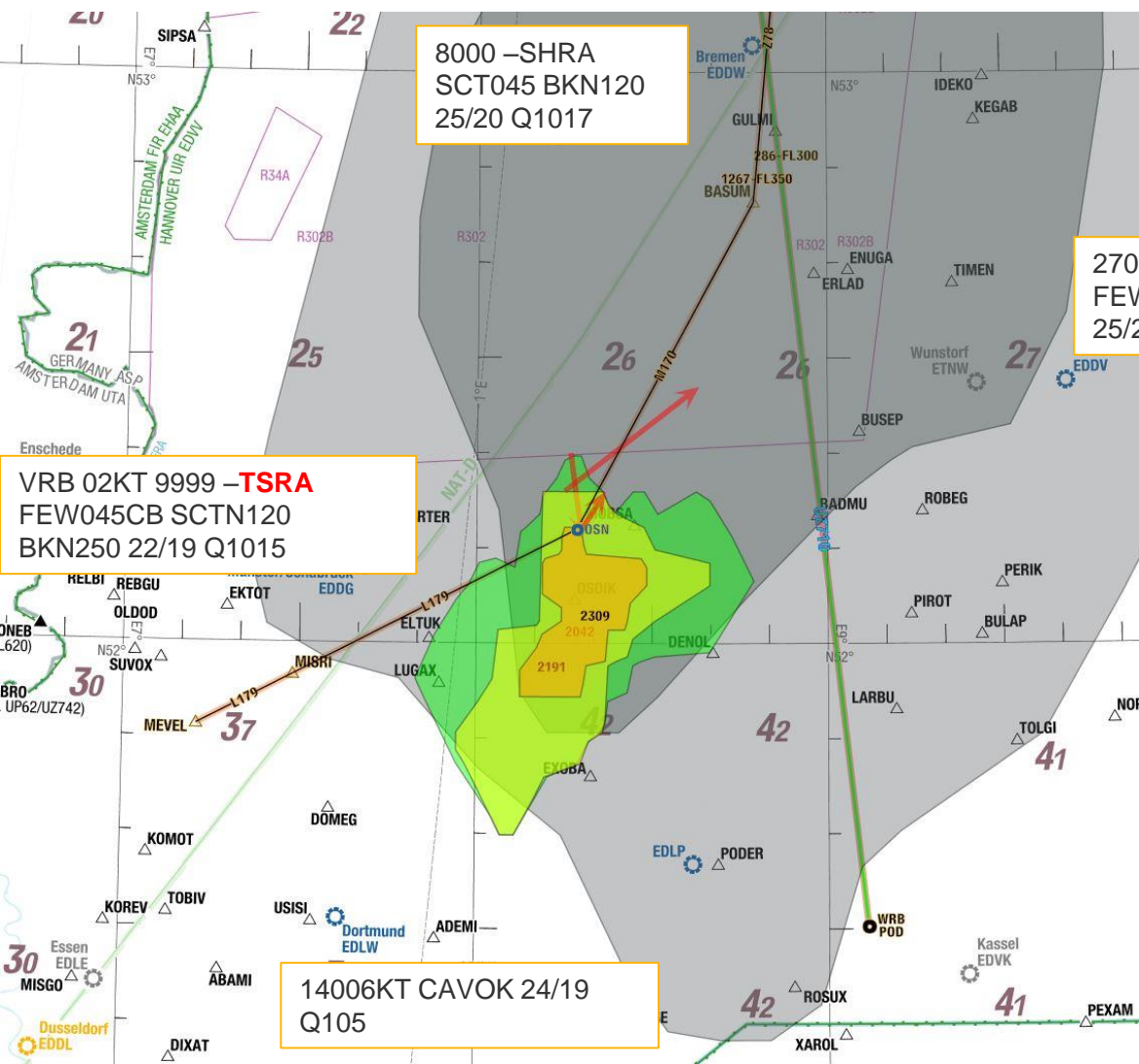
12007KT CAVOK 22/17
Q1015

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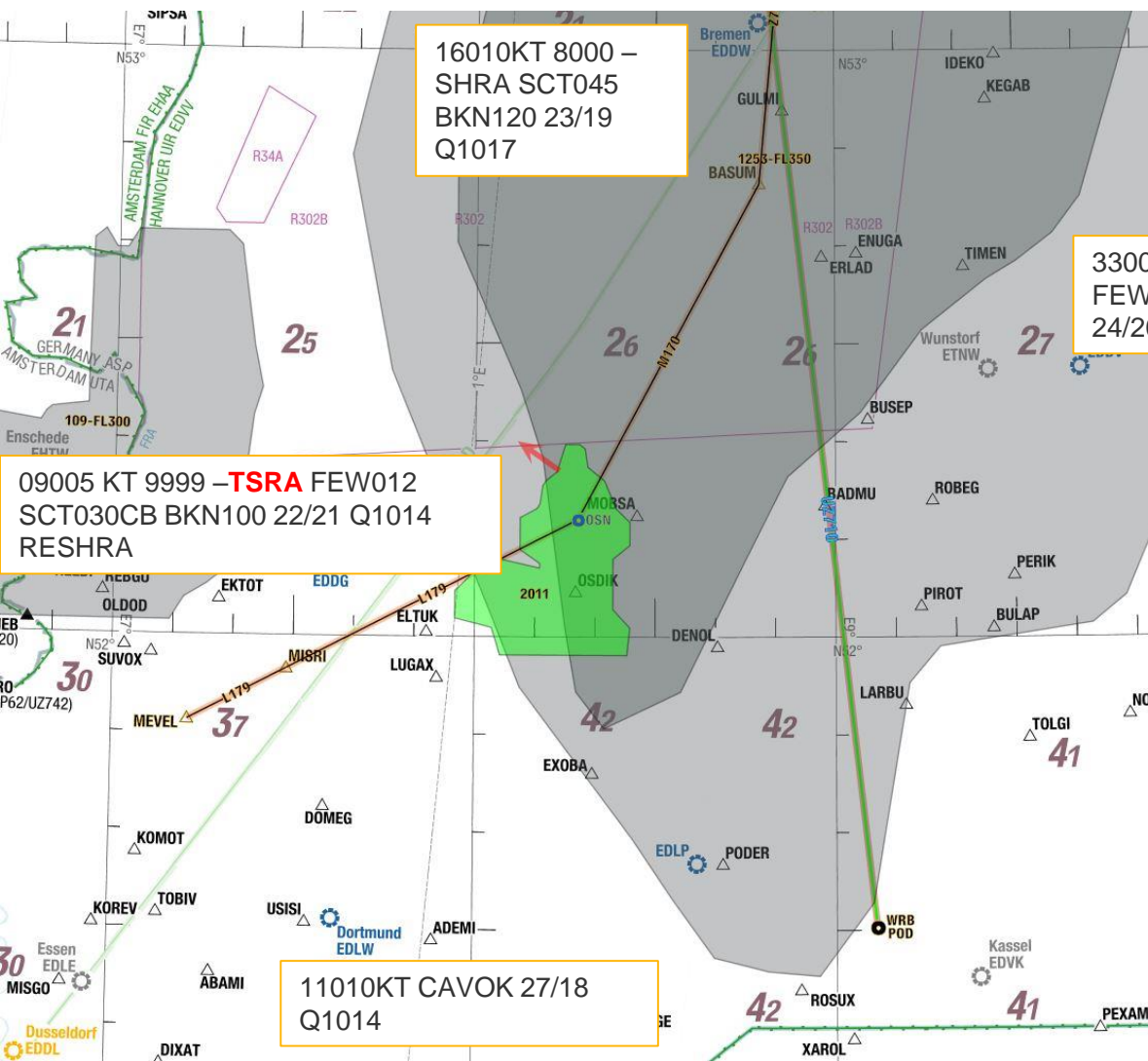


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**SAT/RADAR=11:30
UTC,
METAR=11:20**



16010KT 8000 –
SHRA SCT045
BKN120 23/19
Q1017

**SAT/RADAR=11:45
UTC,
METAR=11:50**

33009KT 9999 –SHRA VCSH
FEW030CB SCT070 BKN120
24/20 Q1017

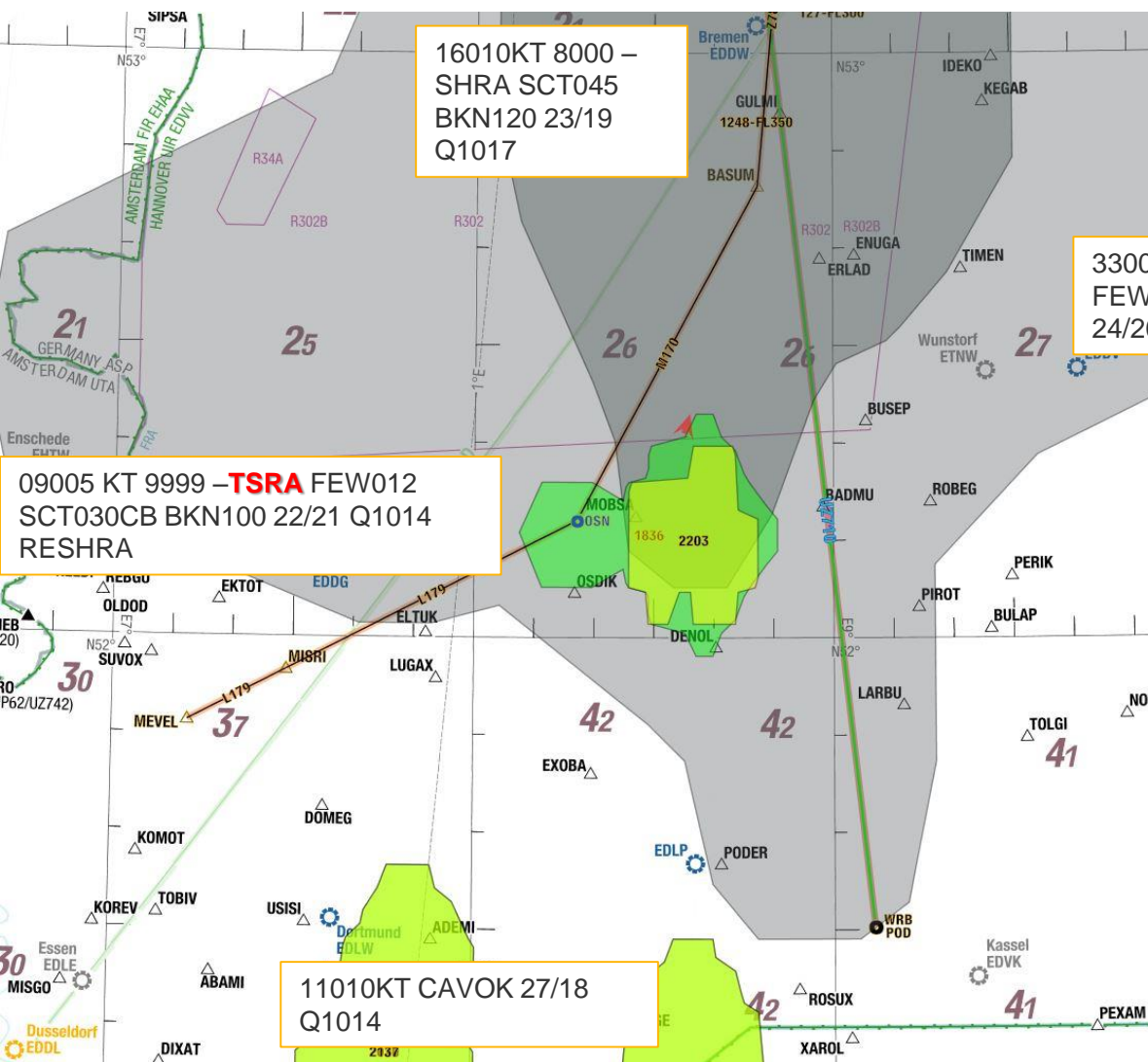
09005 KT 9999 –**TSRA** FEW012
SCT030CB BKN100 22/21 Q1014
RESHRA

11010KT CAVOK 27/18
Q1014

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16010KT 8000 –
SHRA SCT045
BKN120 23/19
Q1017

**SAT/RADAR=12:00
UTC,
METAR=11:50**

33009KT 9999 –SHRA VCSH
FEW030CB SCT070 BKN120
24/20 Q1017

09005 KT 9999 –**TSRA** FEW012
SCT030CB BKN100 22/21 Q1014
RESHRA

11010KT CAVOK 27/18
Q1014

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12010KT 9999 -SHRA
FEW020 SCT045 BKN120
22/18 Q1015

**SAT=12:30 UTC,
METAR=12:20**

03005KT 330V060 9999 VCSH
FEW030CB SCT120 BKN180 25/20
Q1016

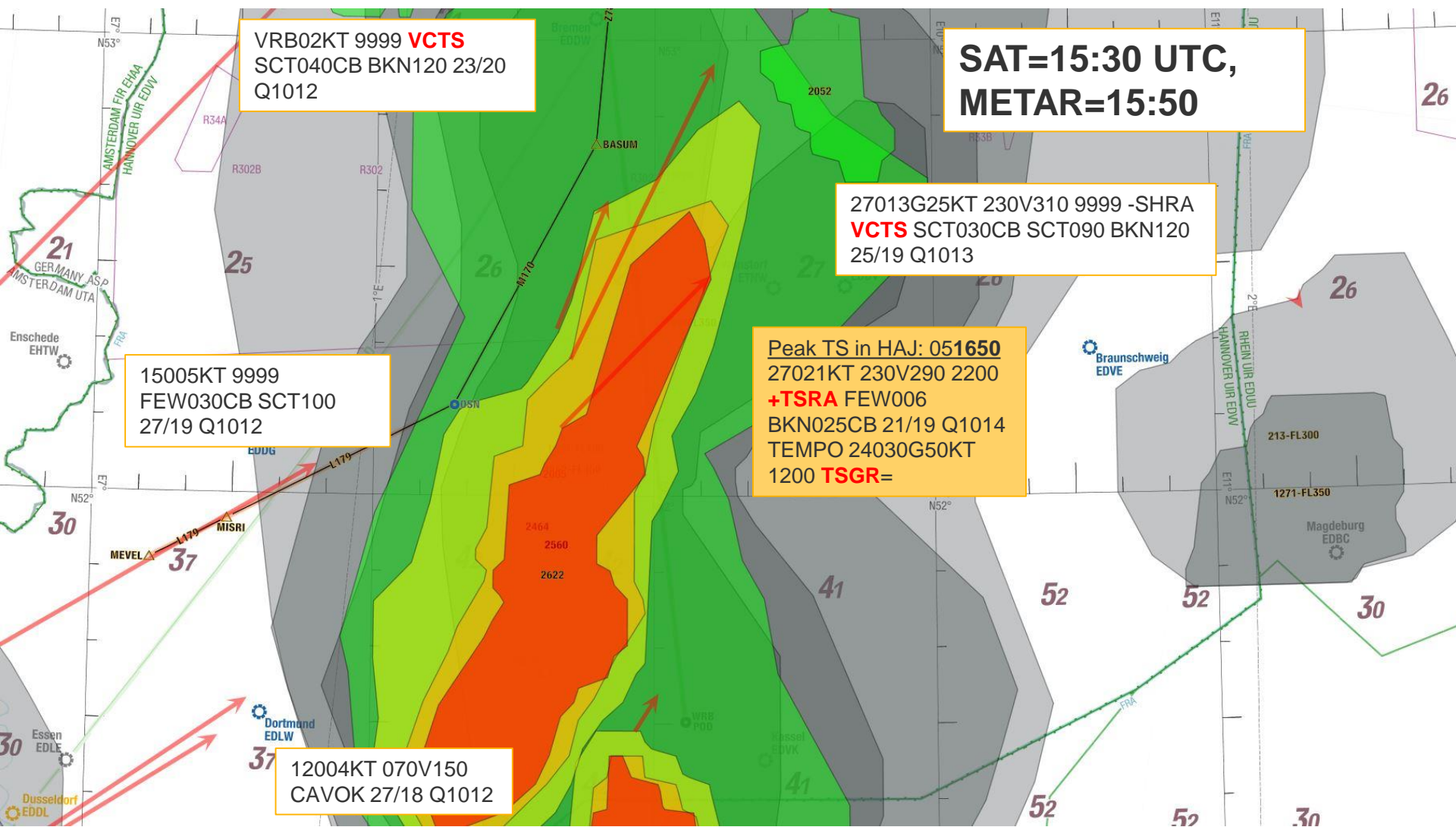
VRB03KT 9999
FEW030CB BKN100
24/20 Q1014 **RETS**

12015KT 9999 **VCTS**
SCT100CB 27/14
Q1014

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VRB04KT 9999 -SHRA
SCT040CB OVC120 22/20

Peak TS in BRE: 051850 25015KT 5000 -
TSRA SCT012 BKN035CB 21/19 Q1013
TEMPO 26020G40KT 4000 **TSRA**
BKN012=

35009KT 9999 VCTS FEW010
FEW030CB SCT120 BKN250 19/16
Q1013 **RETS**

31009KT 240V350 9999
FEW035 BKN060 21/14
Q1014

**SAT=17:45 UTC,
METAR=17:50**

VRB05KT 9999 FEW006
BKN025CB BKN210 20/19 Q1013
RETS

Peak TS in HAJ: 051650
27021KT 230V290 2200
+TSRA FEW006
BKN025CB 21/19 Q1014
TEMPO 24030G50KT
1200 **TSGR**=

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31010KT 9999 **VCTS** SCT040CB
BKN120 20/19 Q1013 RERA

Peak TS in BRE: 051850 25015KT 5000 -
TSRA SCT012 BKN035CB 21/19 Q1013
TEMPO 26020G40KT 4000 **TSRA**
BKN012=

**SAT=19:15 UTC,
METAR=19:20**

20004KT 120V280 9999 -RA
FEW007 SCT025CB BKN070 20/19
Q1012 **RETS**

26005KT 9999 FEW045
SCT120 BKN250 19/17
Q1015 NOSIG

VRB04KT 9999 -
SHRA BKN060CB
18/14 Q1015

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30008KT 9999 FEW040CB
BKN120 19/18 Q1013
NOSIG

**SAT=20:00 UTC,
METAR=19:50**

26010KT 220V290 9999 FEW007
BKN025 OVC070 21/19 Q1014

27005KT CAVOK 19/17
Q1015

VRB03KT 9999 -SHRA
FEW035CB SCT090 18/15
Q1015

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SAT=20:00 UTC

Conclusion:

No issue found. BCI/NCAR data always in agreement with METARs