Characterization of the life cycle of convection from initiation to decay on the basis of case study from July, 15th 2007

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in der Helmholtz-Gemeinschaft

8th COPS workshop 26.-28.10.2009, Cambridge, UK

Outline

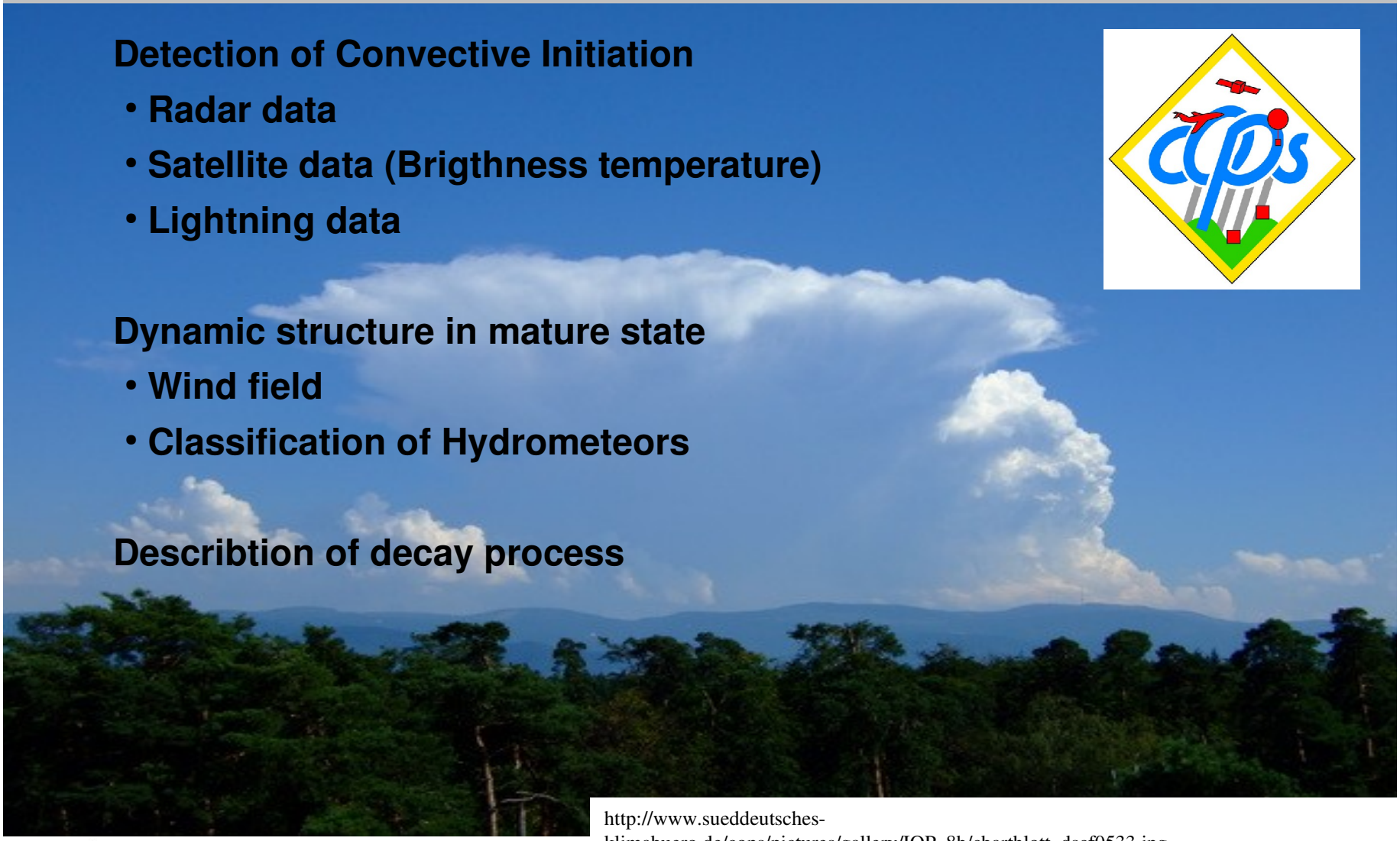
Detection of Convective Initiation

- Radar data
- Satellite data (Brigthness temperature)
- Lightning data

Dynamic structure in mature state

- Wind field
- Classification of Hydrometeors

Describtion of decay process



http://www.sueddeutsches-klimabuero.de/cops/pictures/gallery/IOP_8b/cbarthlott_dscf0533.jpg

Situation on July, 15th 2007 (IOP 8b)

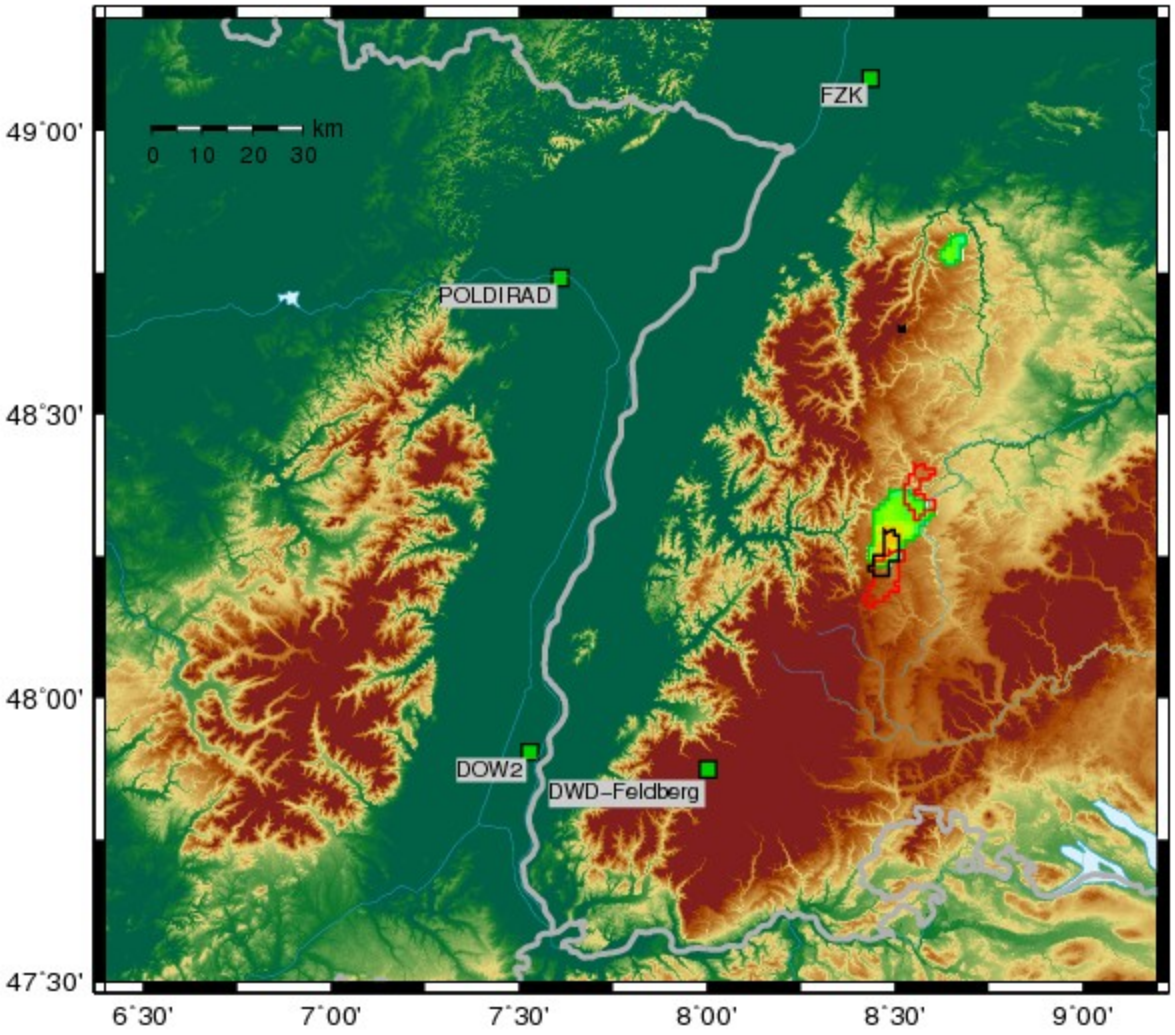
Number of radar sites: 4

Black: First radar cell
14:20 UTC

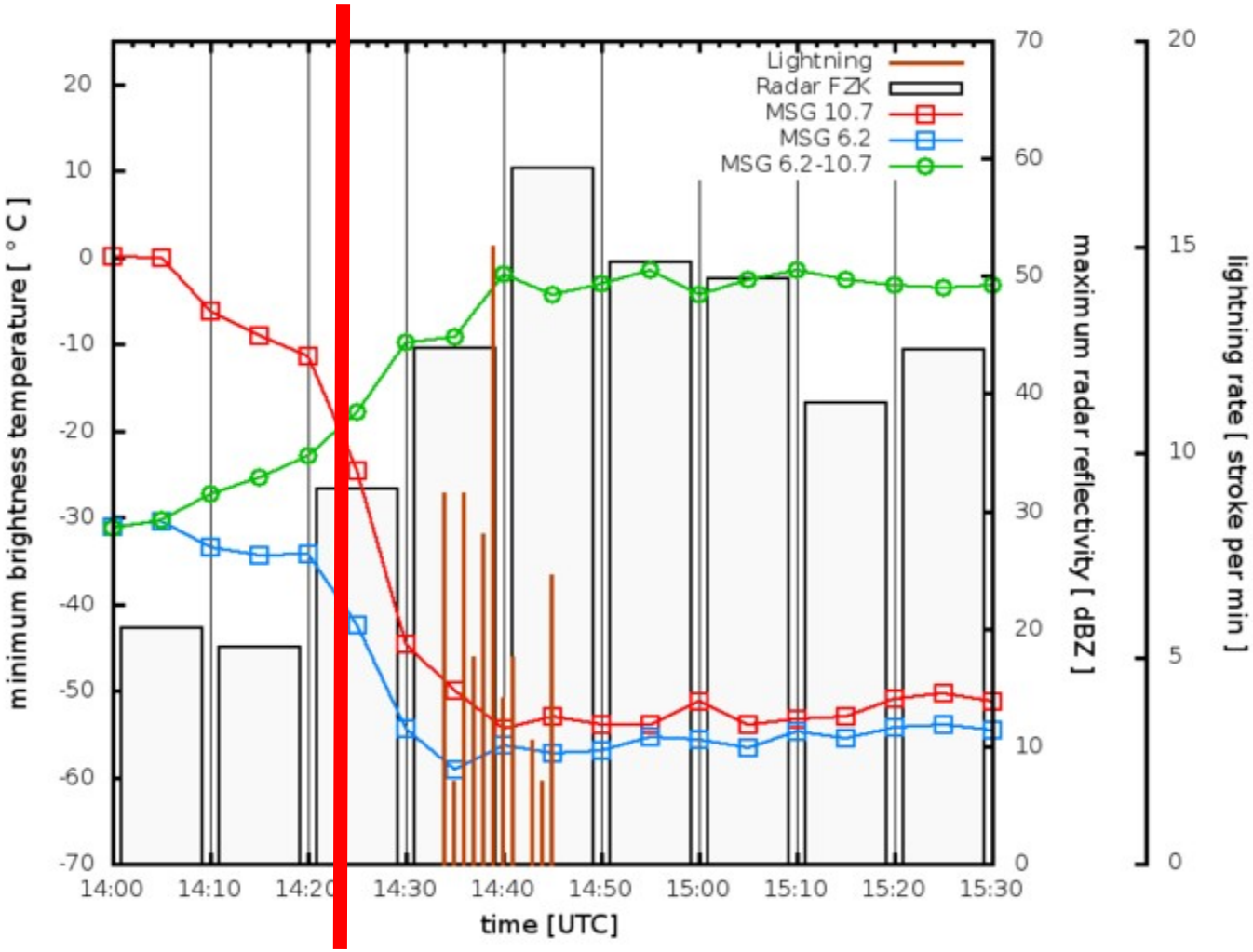
Green: Largest cell size
14:30 UTC

Red: Last radar cell
15:30 UTC

cell: reflectivity > 20 dBz



Evolution of convection



Cell initiation(CI) at 14:20 UTC

CI	Critical value
10.7 µm TB	< 0 ℃
10.7 µm TB time trend	< -4 ℃ / 15min
6.5 – 10.7 µm difference	-35 to -10 ℃
6.5 – 10.7 µm time trend	> 3 ℃ / 15 min

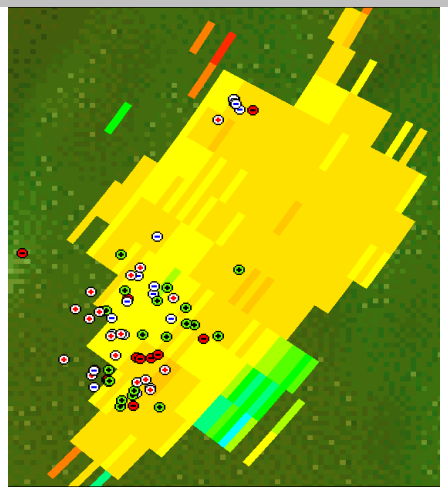
Mecikalski and Bedka, 2006

Radial velocities

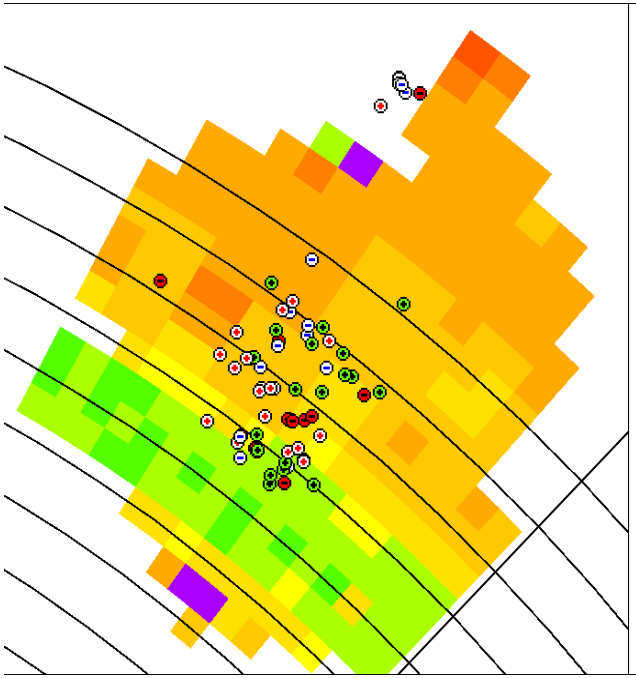
Comparing of the radial velocities of all four radar data

Relative far length between radar sites

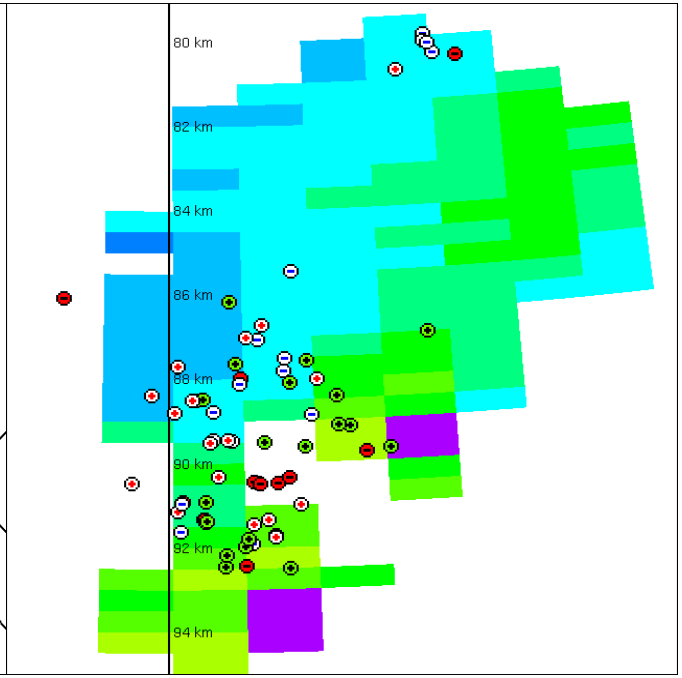
Relative small cell size



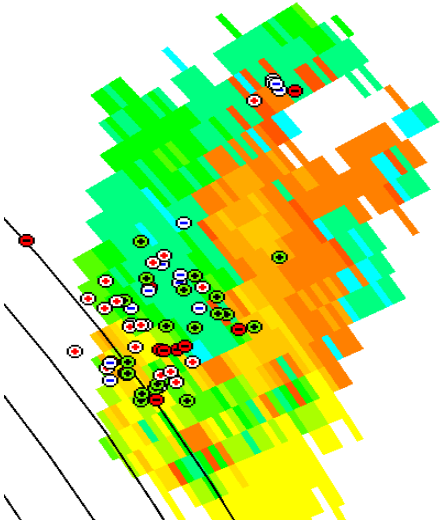
DLR-POLDIRAD, Waltenheim



DWD-Feldberg

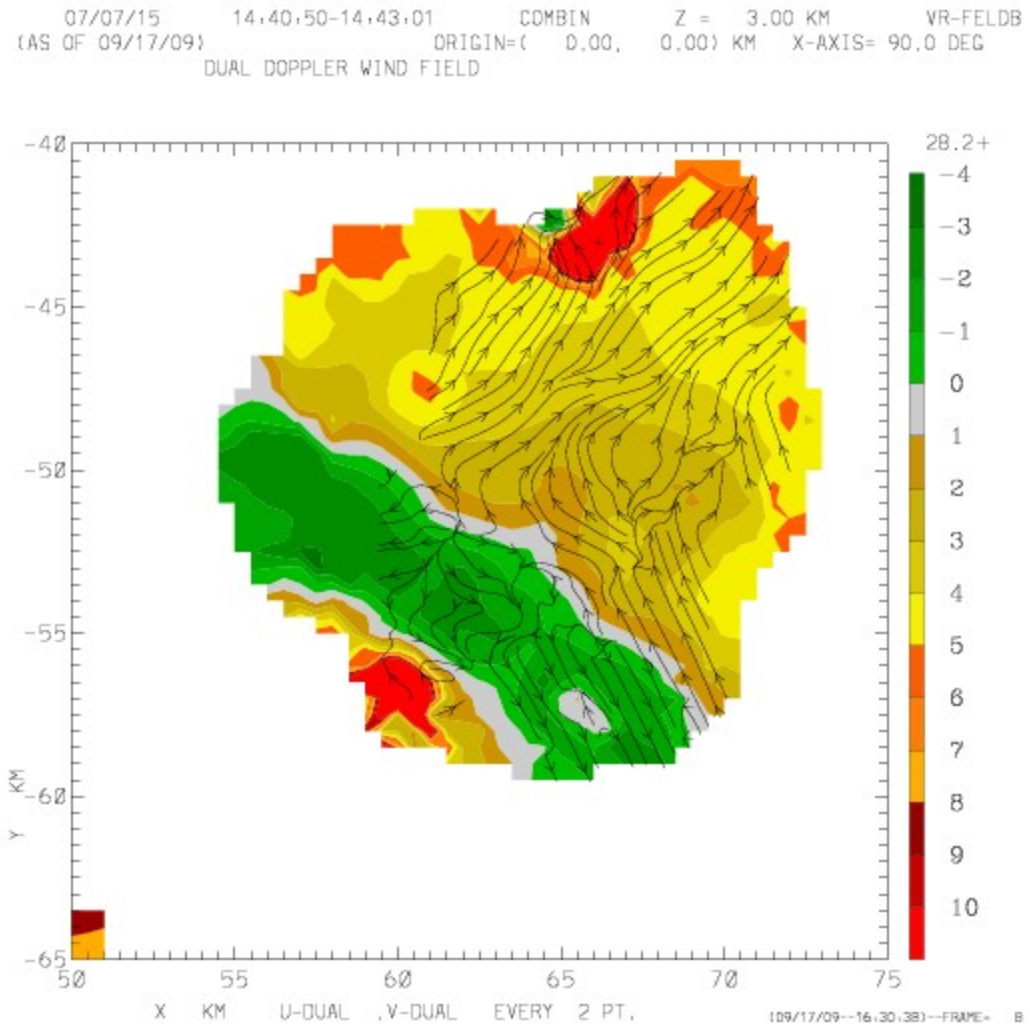


IMK-Karlsruhe

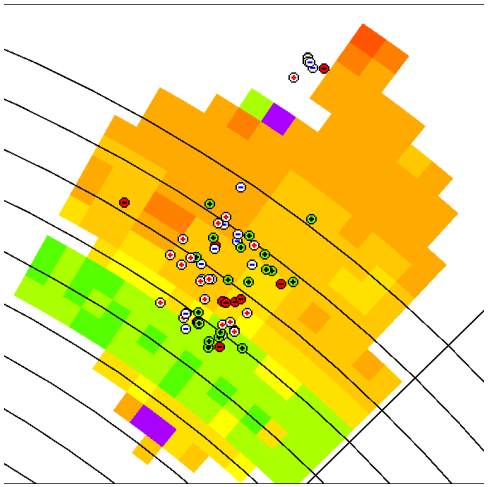


DOW2-Fessenheim

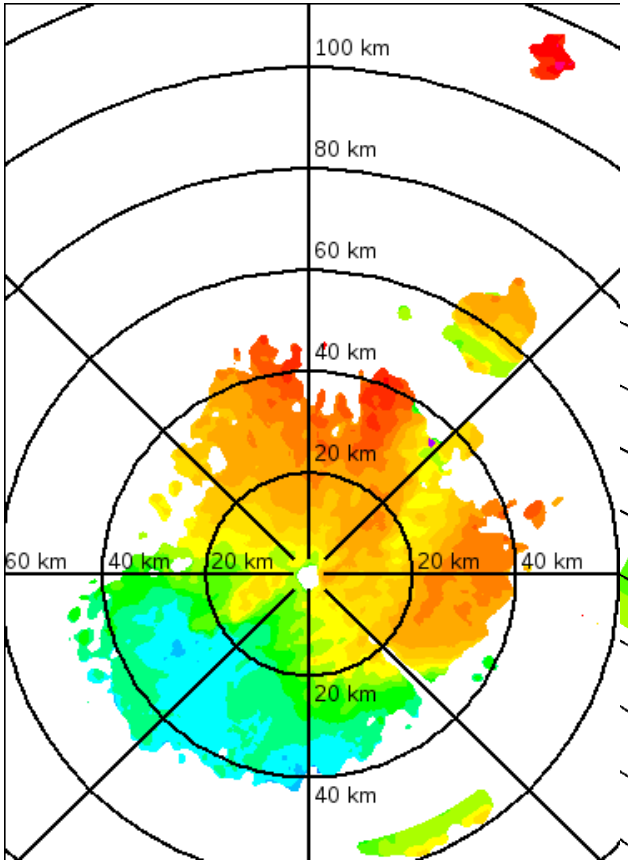
Estimation of the wind field by using dual-doppler method



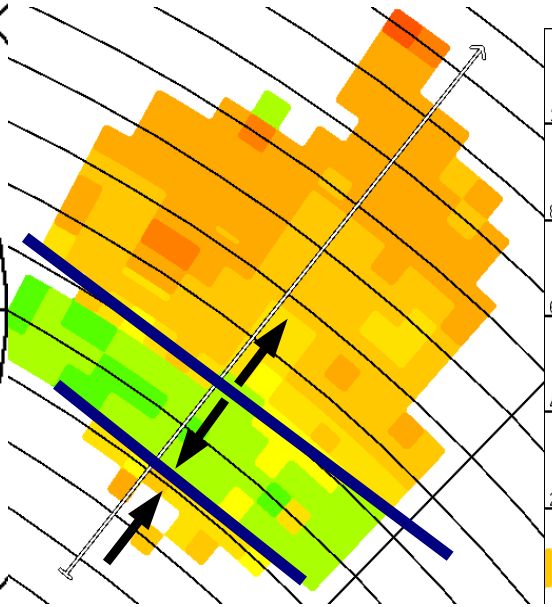
- Data gridded to a common volume by using SPRINT
- U and V wind components computed by using CEDRIC

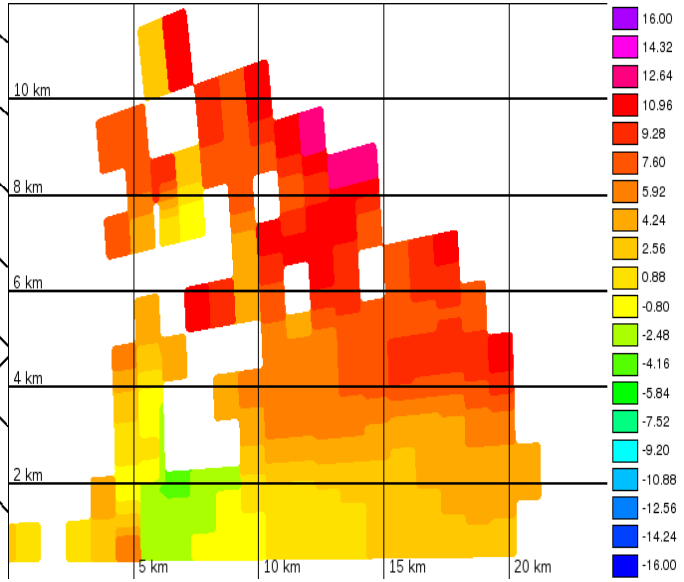


Radial velocity, Feldberg radar



Divergence and convergence structure



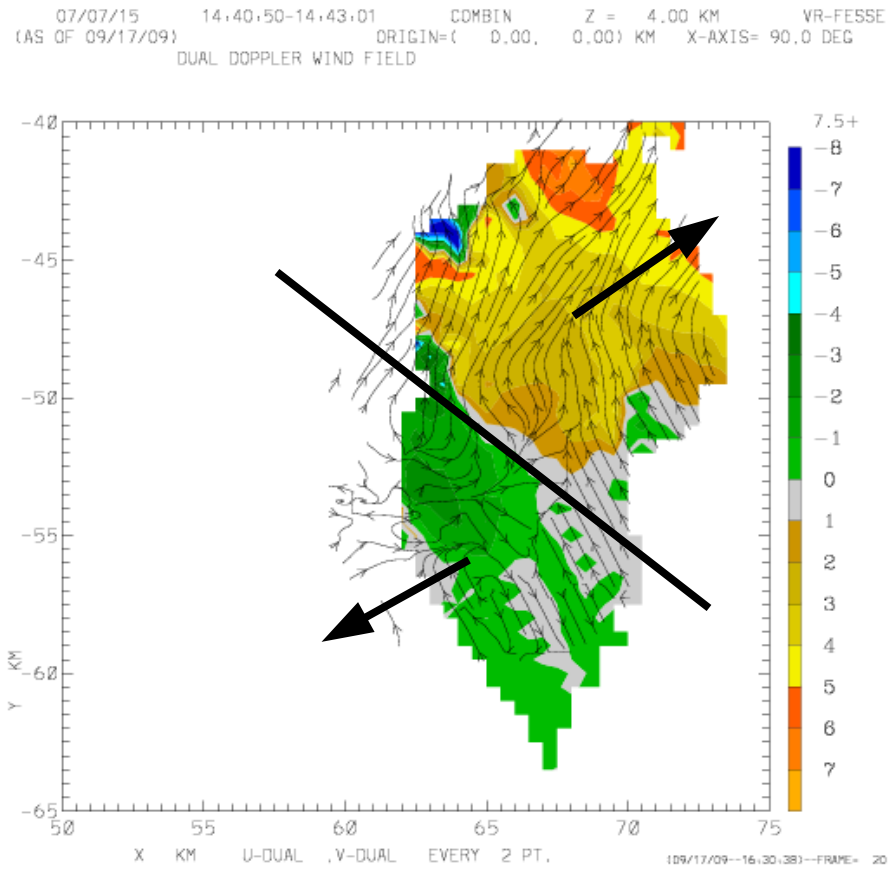


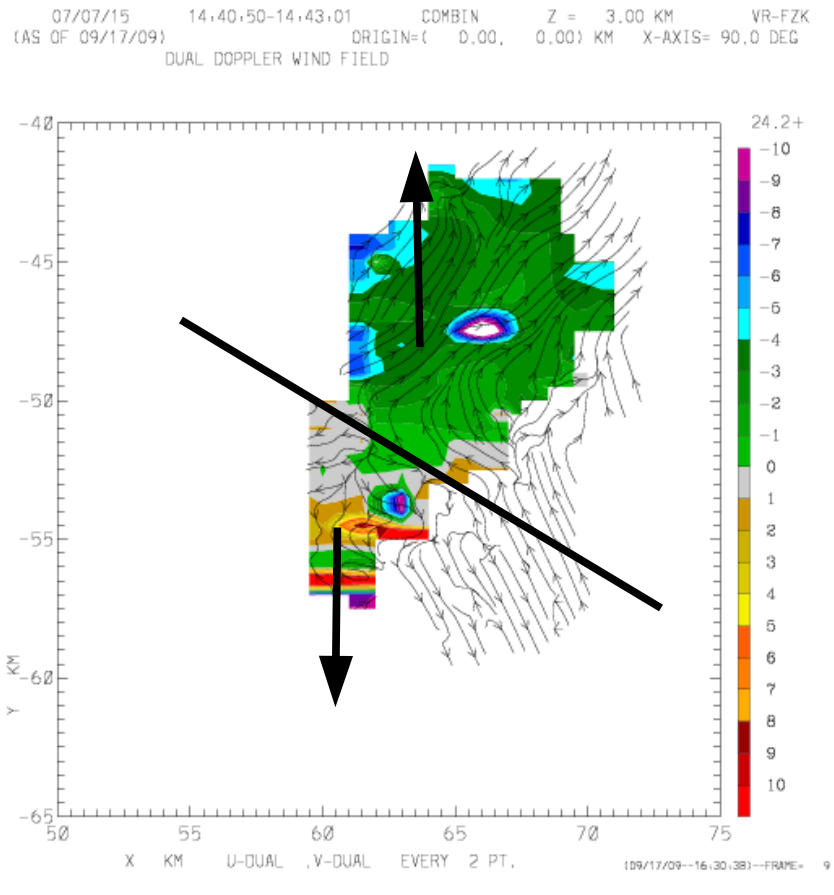
PPI at 14:37:36
elevation: 1.5 °

CAPPI
height: 2.0 km

Vertical cross section

Divergence Line?

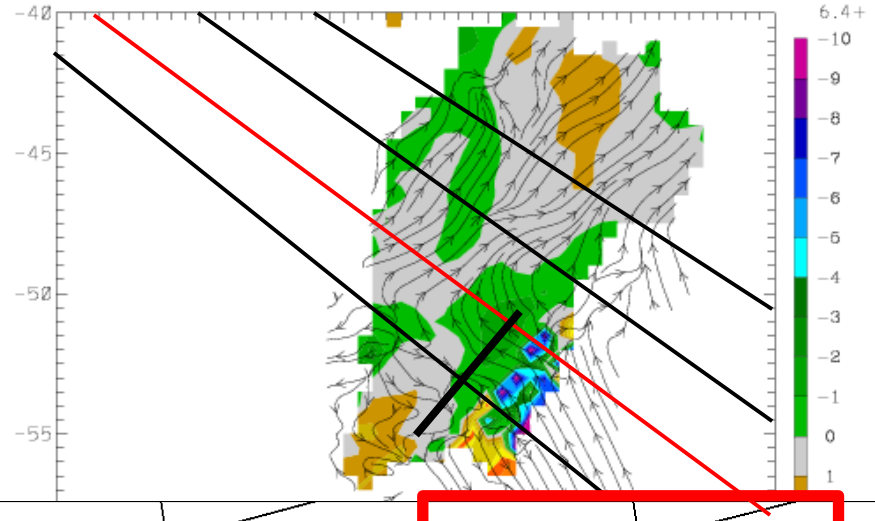




DOW, Fessenheim
Origin: -6, -93

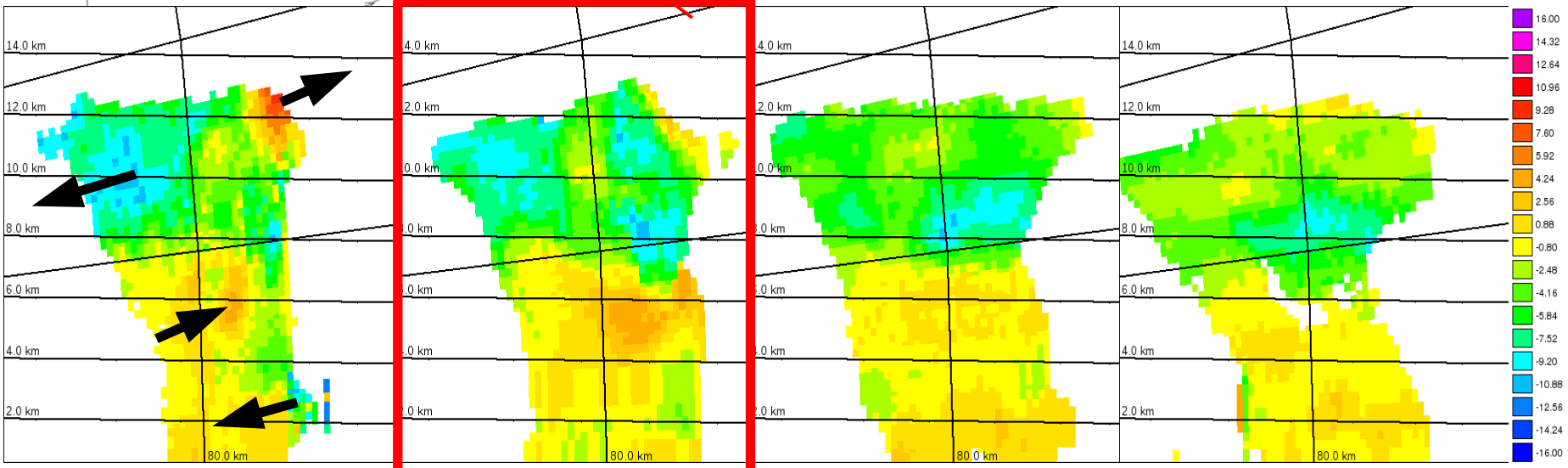
IMK, Karlsruhe
Origin: 61, 39

3D wind field



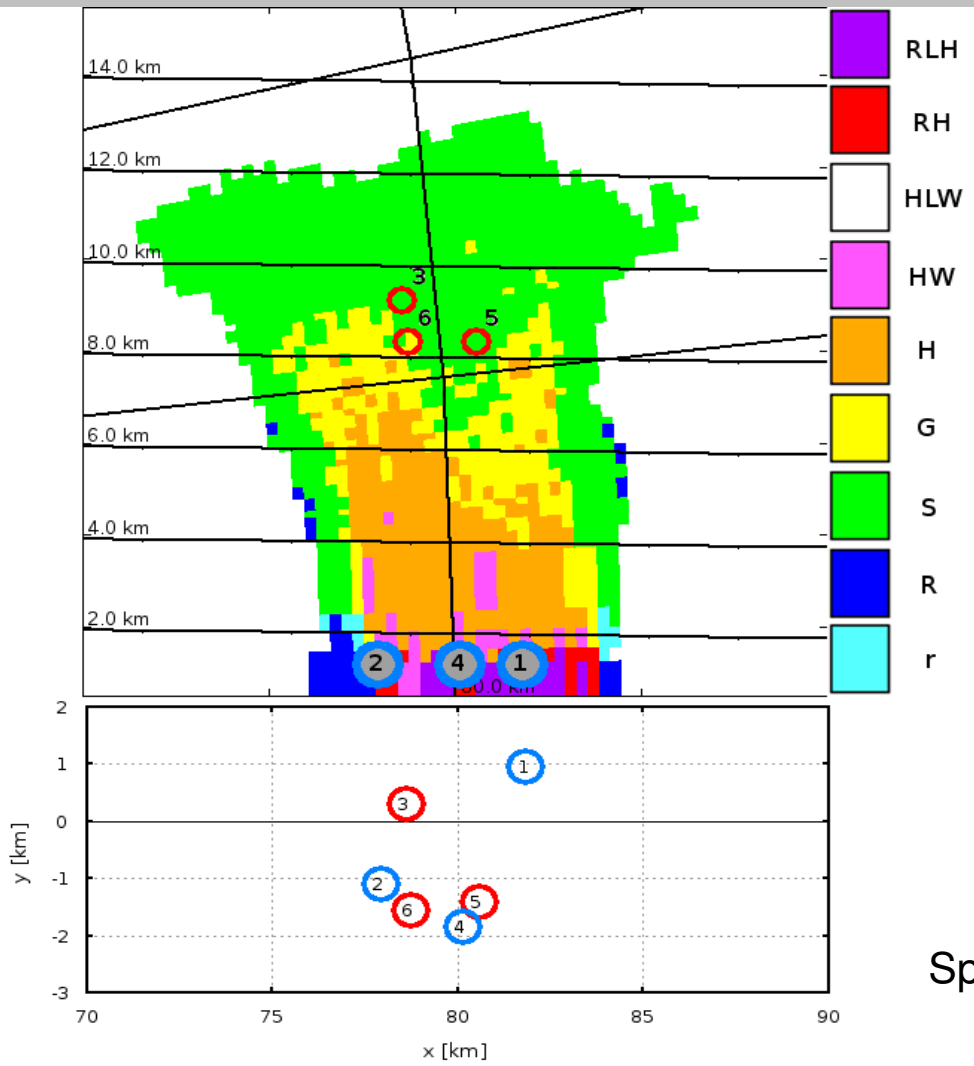
Convergence structure at ground?

Poldirad (DLR) PPI taken at
14:40:50 (elevation: 1°)
14:41:34 (elevation: 2°)



130°, 14:44:28 | 128°, 14:44:10 | 126°, 14:43:53 | 124°, 14:43:36

Investigation of microphysical processes



Range height indicator scan at 14:44:10, 128°

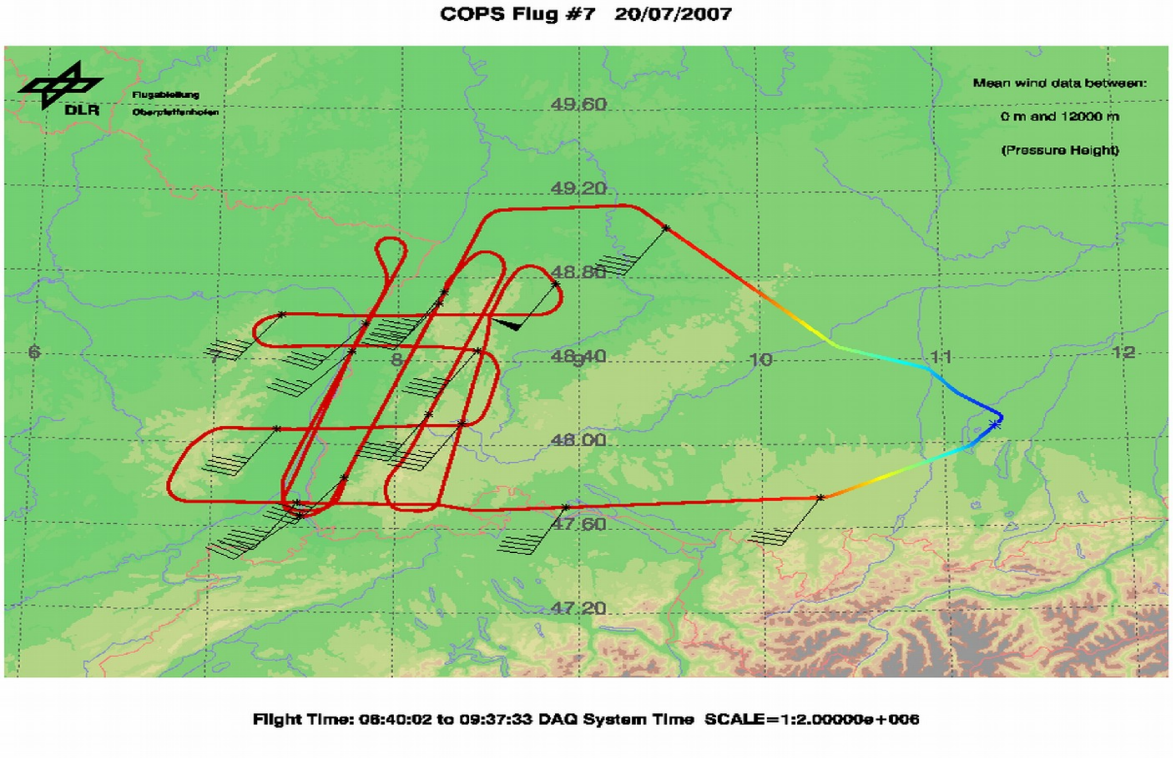
Classification of hydrometeors after Höller et al. 1994

Stroke No.	Time [UTC]
1	14:41:12.599
2	14:43:05.328
3	14:43:05.330
4	14:43:05.333
5	14:44:23.836
6	14:44:23.878

Spatial and temporal overlay in a very small range

Future plans

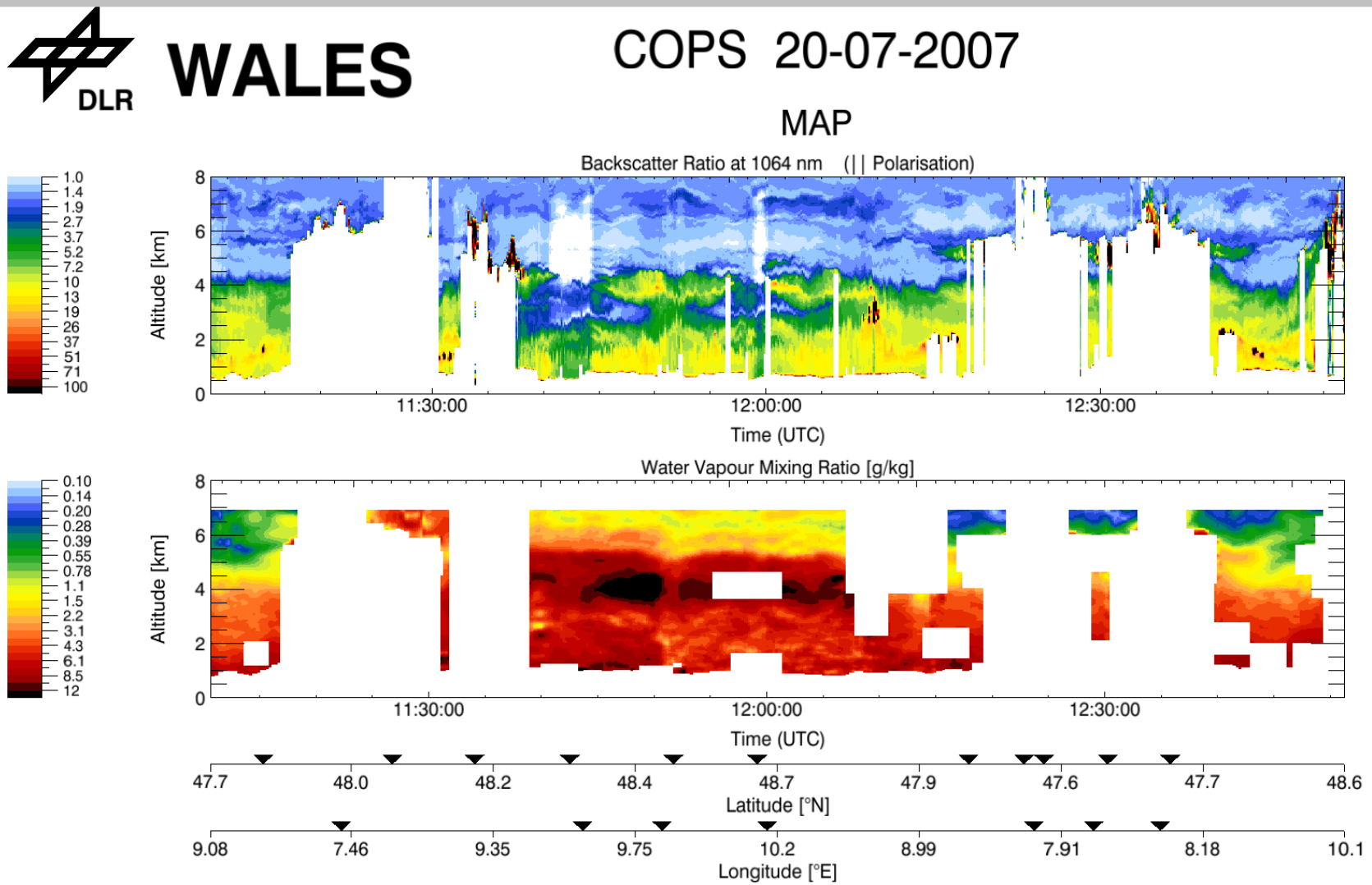
- Better calculation of the 3D wind field, in- and outside of the radar cells
- Second case study: 20.07.2007 with additional wind data, e.g. LIDAR-airborne data



Conclusion

- Describtion of life cycle from initiation to decay
- Wind field estimated while mature state by using Dual-doppler method with data of 4 radar sites
- Investigation of microphysical processes

Lidar data


DLR
WALES
COPS 20-07-2007
MAP
Backscatter Ratio at 1064 nm (|| Polarisation)
1.0
1.4
1.9
2.7
3.7
5.2
7.2
10
13
19
26
37
51
71
100
Altitude [km]
0
2
4
6
8
11:30:00
12:00:00
12:30:00
Time (UTC)
Water Vapour Mixing Ratio [g/kg]
0.10
0.14
0.20
0.28
0.39
0.55
0.78
1.1
1.5
2.2
3.1
4.3
6.1
8.5
12
Altitude [km]
11:30:00
12:00:00
12:30:00
Time (UTC)
47.7
48.0
48.2
48.4
48.7
47.9
47.6
47.7
48.6
Latitude [°N]
9.08
7.46
9.35
9.75
10.2
8.99
7.91
8.18
10.1
Longitude [°E]
Preliminary quick-look data. Processed on 16-07-2008 Contact: DLR Institute of Atmospheric Physics Gerhard.Ehret@dlr.de