



Use of improved remote sensing data for a better nowcasting of severe weather events

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1. Data for nowcasting at *Deutscher Wetterdienst* (DWD)

2. Radar data as main input for nowcasting:
 - network configuration and scan strategy
 - operational and pre-operational radar products

3. Weather warnings and their visualisation



➤ Nowcasting data at *DWD*

data:	resolution:	update:	used for:	new:
satellite (Meteosat RSS)	3 km	5 min	convection fog	day–night-composite with HRV data
radar	250 m / 1 km	5 min	precipitation+ structure	dual-pol radar data
lightning (LINET)	1 km	1 min	thunderstorm	
additional observation SYNOP, METAR, radiosonde				
model data (COSMO, ICON)	2.8 km	3 h		also probabilistic data

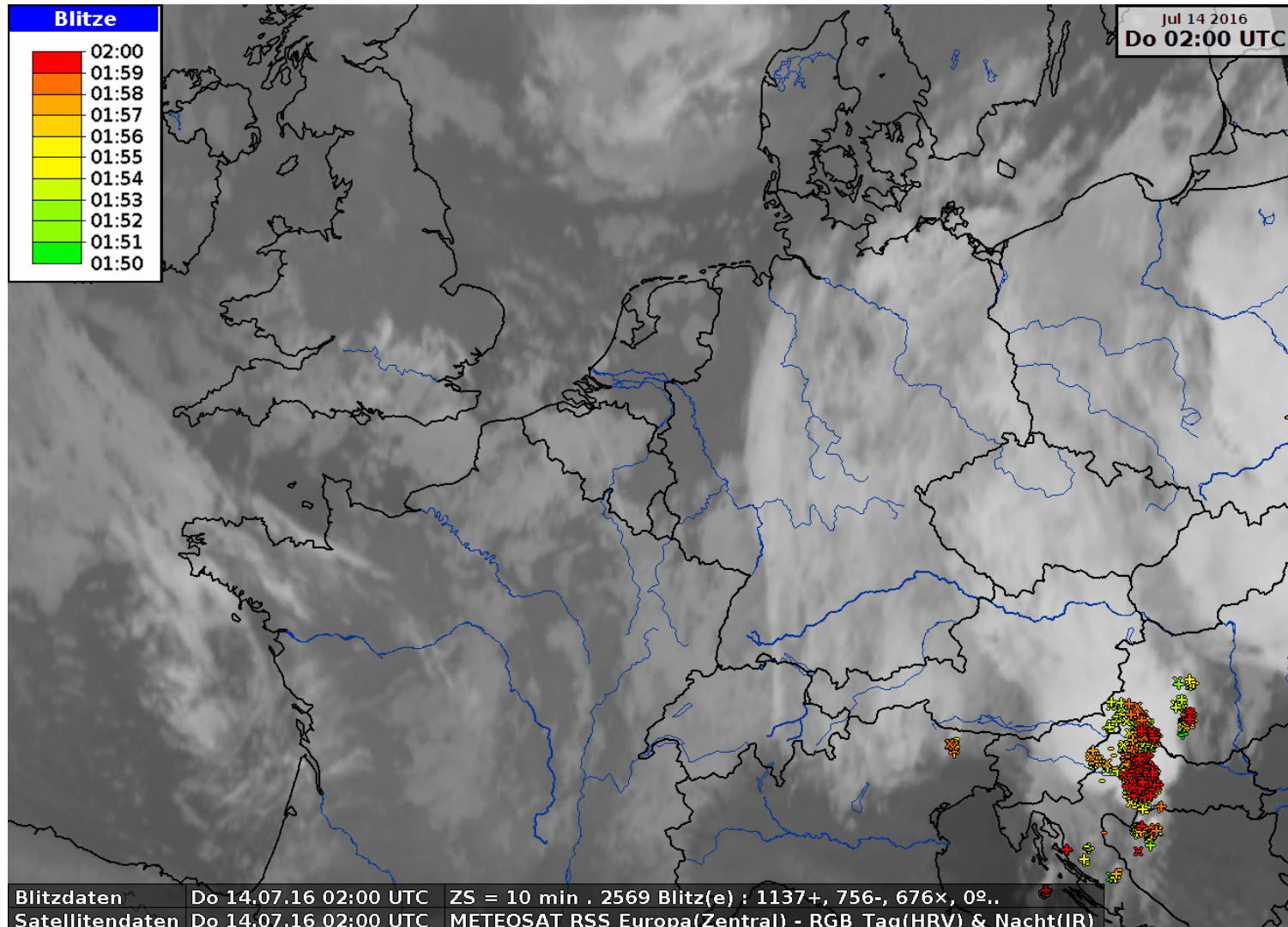
➤ Nowcasting data at *DWD*



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Wetter und Klima aus einer Hand



Day-night composite (IR 10.8 + HRV 0.4-1.1) Meteosat rapid scanning service (RSS)
+ lightning detection (LINET)

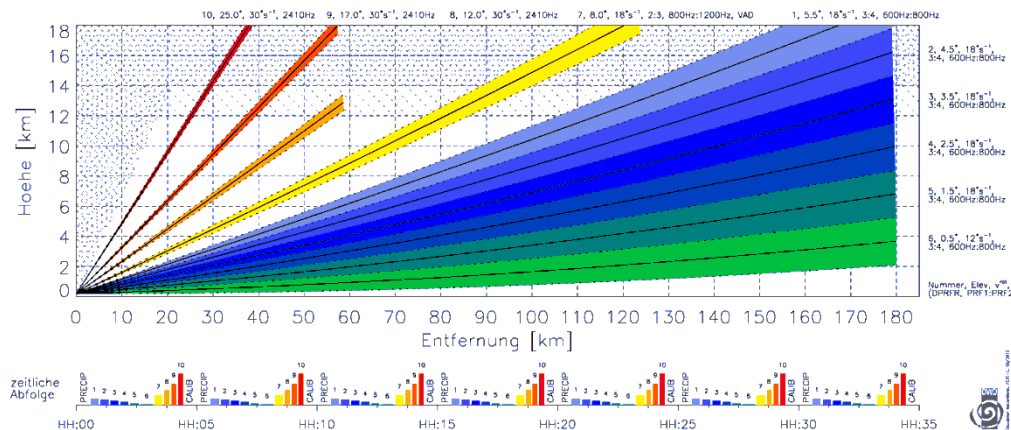
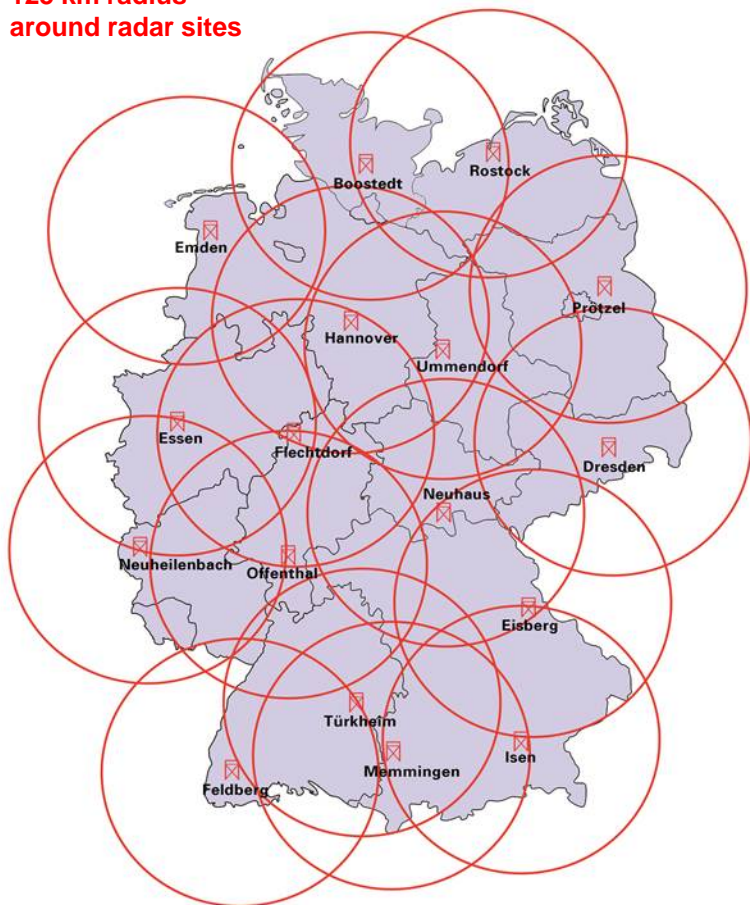


➤ *RADAR* network + scan strategy



network of 17 operational radars

125 km radius
around radar sites



■ Volume scan of 10 elevations:

- 5.5° down to 0.5°
- 8.0° up to 25°
- 90° calibration scan

range bins of **1 km** up to **180 km**, 1° azimuth –
repetition cycle of **5 min**

■ „Precipitation scan“ (terrain following)

range bins of **250 m** up to **150 km**, 1° azimuth –
repetition cycle of **5 min**

➤ *RADAR* products (winter)



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Saarländischer
Rundfunk



Saarländischer
Rundfunk

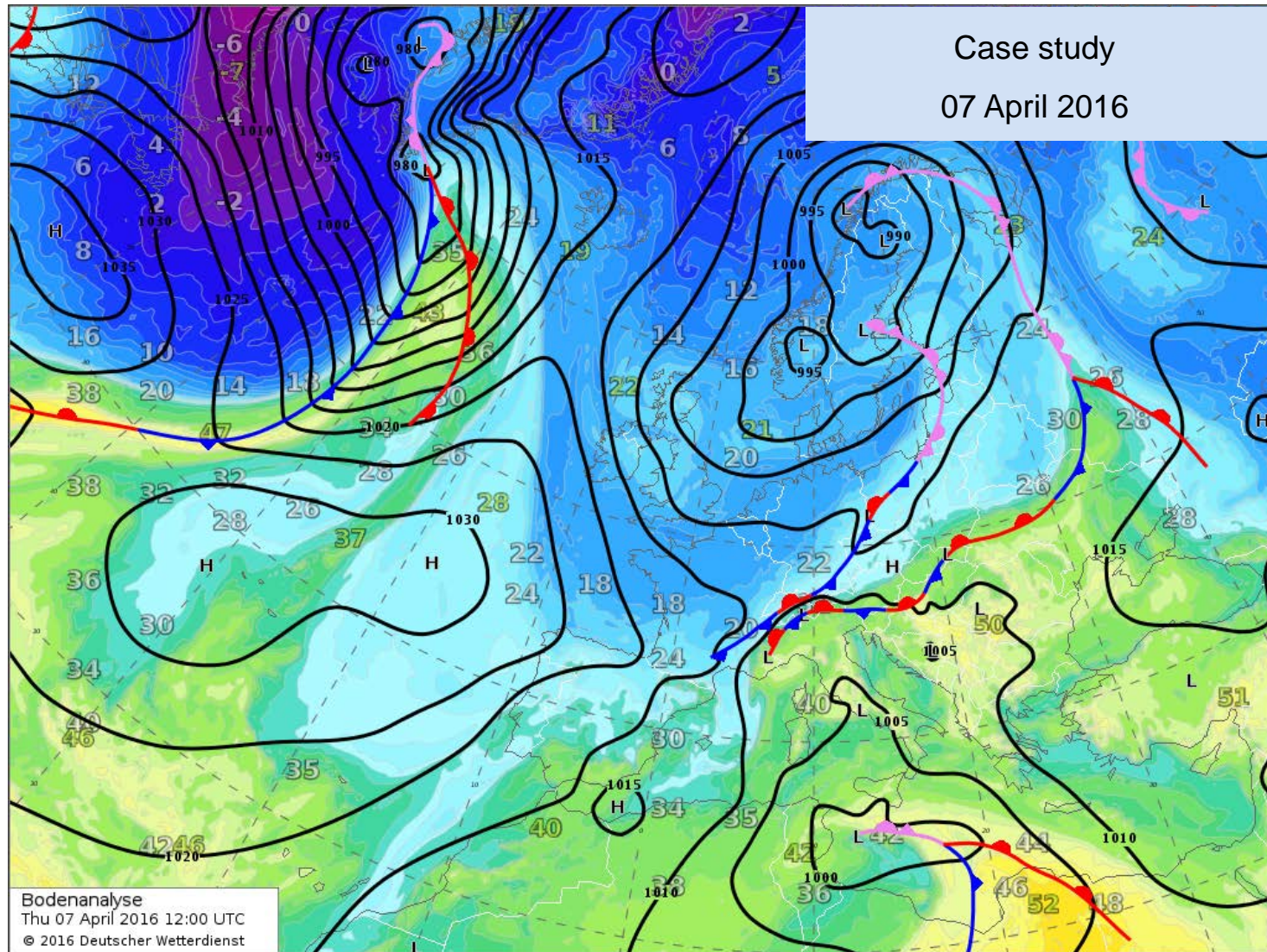


dpa bildfunk

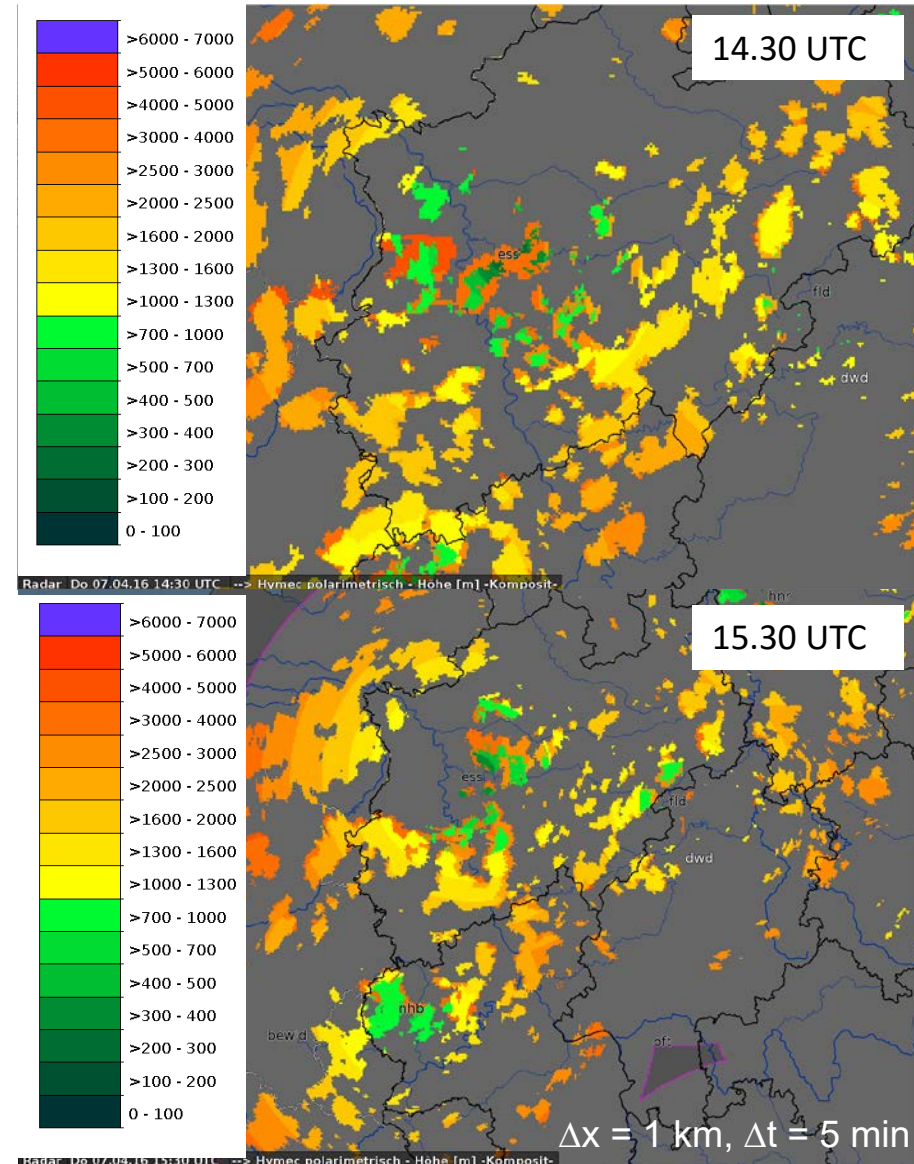
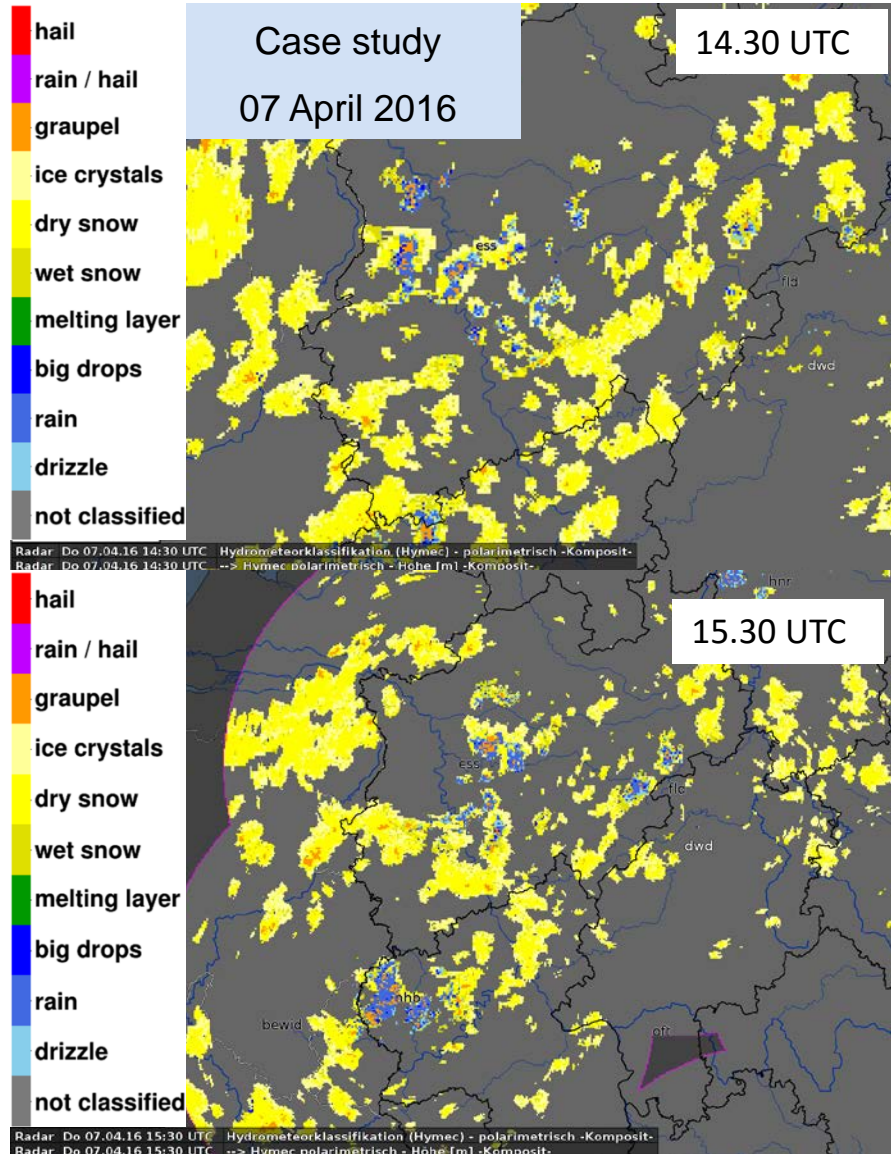


Augsburger Allgemeine

➤ *RADAR* products (winter)



➤ RADAR products (winter)



➤ *RADAR* products

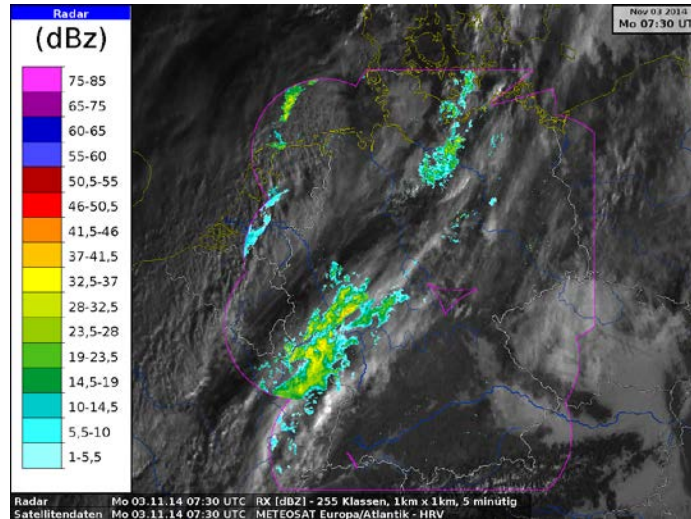


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Precipitation in South-Western Germany:

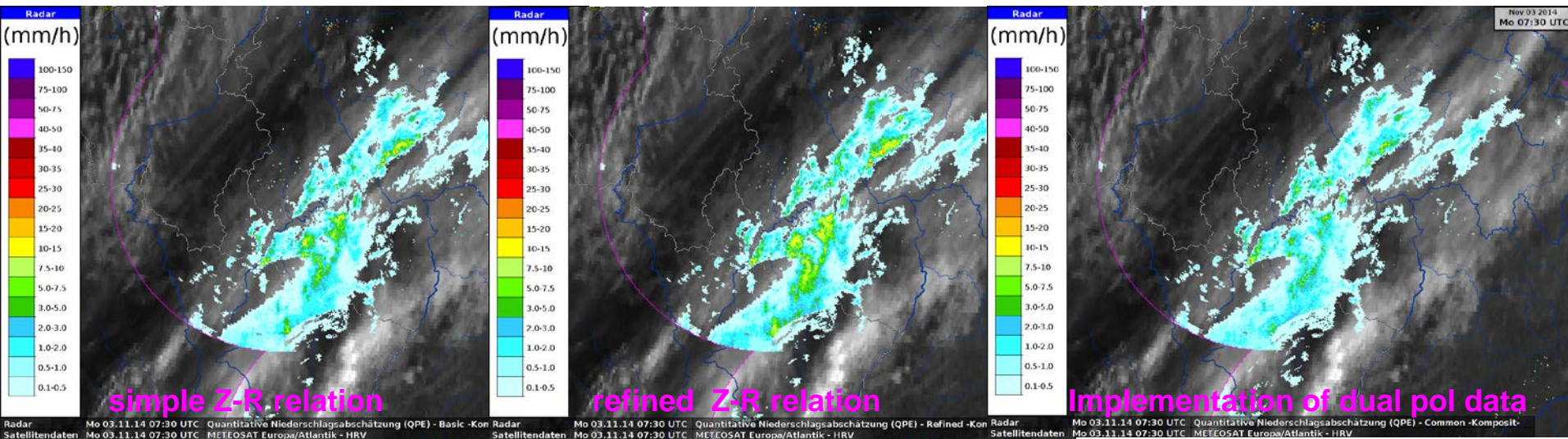
Reflektivität in dBZ:



Case study
03 November 2014

Precipitation rate in mm/h:

$\Delta x = 1 \text{ km}, \Delta t = 5 \text{ min}$

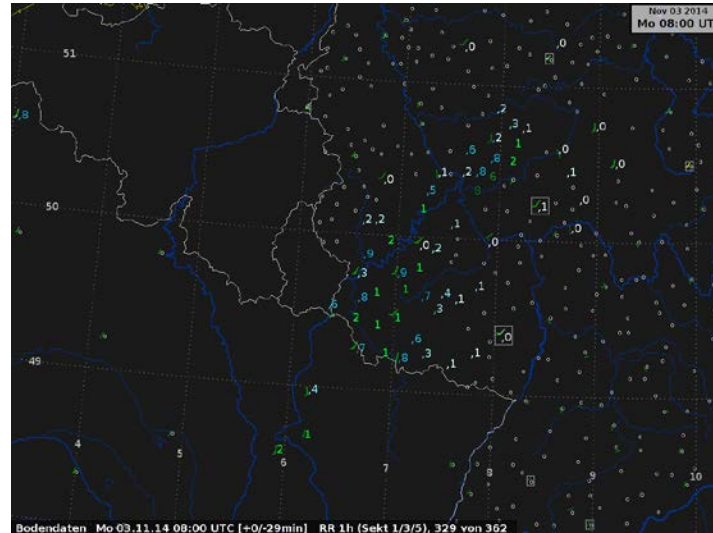


➤ *RADAR* products



Precipitation in South-Western Germany:

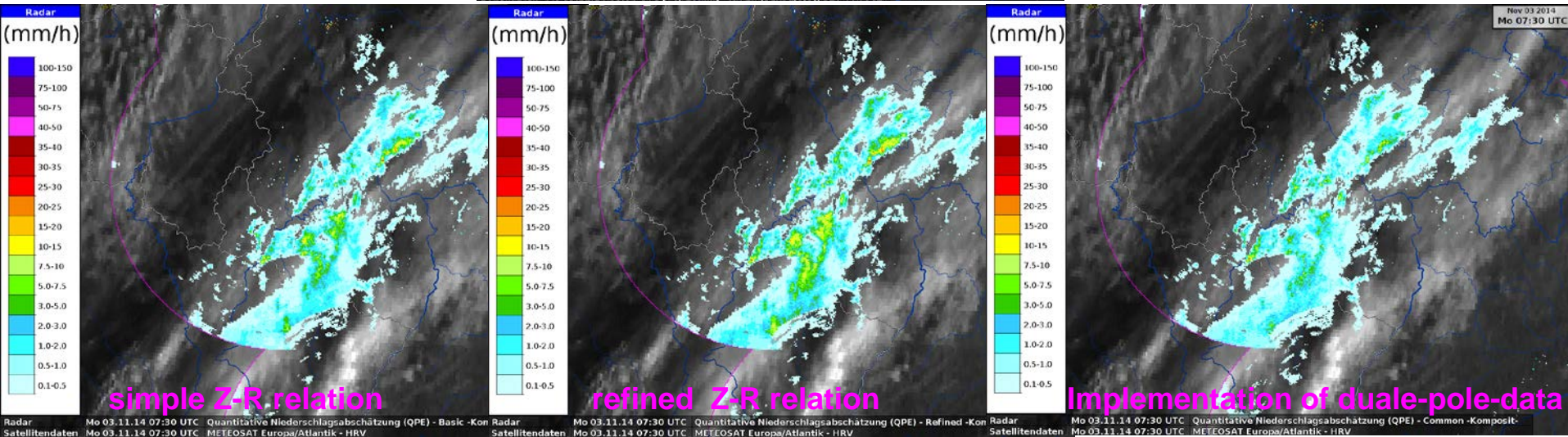
1h-precipitation rate
at the ground:



Case study
03 November 2014

$\Delta x = 1 \text{ km}, \Delta t = 5 \text{ min}$

Precipitation rate in mm/h:



➤ *RADAR* products (summer)



operational:

- reflectivity + radial wind velocity data
- cell objects: KONRAD + CellMOS + meso-cyclone algorithms

pre-operational:

- identification of heavy precipitation possibility:
VIL, VII, VIL track, VII track
- identification of rotation:
rotation + 3h-rotation track (mid level → z=3-6 km)
rotation + 3h-rotation track (low level → z=0-3 km)

in planning:

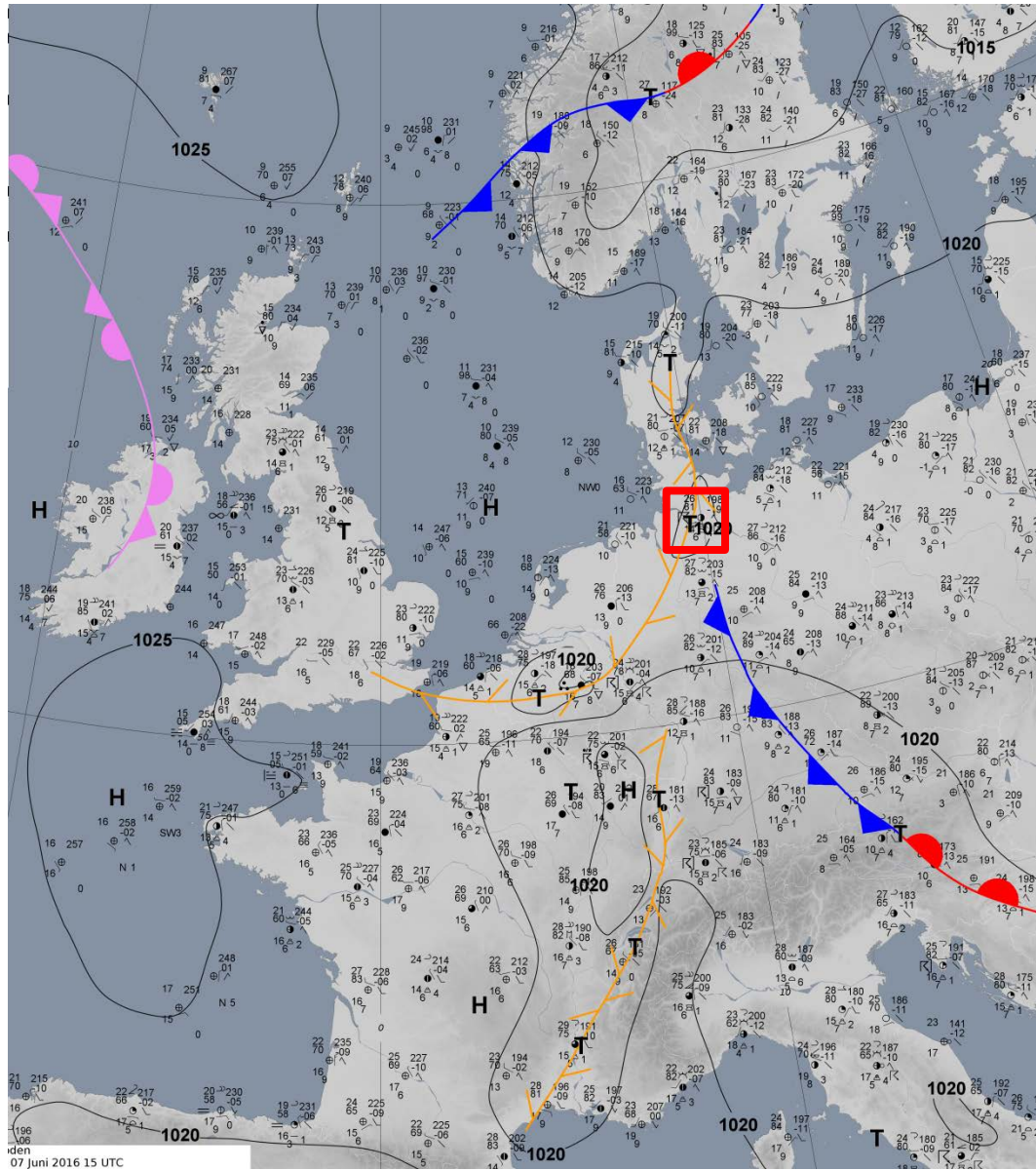
- High-resolution radar data signals
 - TVS signals („tornado vortex signature“)
 - tornado gene
 - identification by gradient of flow velocity between inflow and outflow

➤ RADAR products (summer)



Case study
07 June 2016

heavy precipitation event
including tornadoes
above Northern Germany
(city of Hamburg)



➤ *RADAR* products (summer)



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heavy precipitation event including tornadoes
above Northern Germany (city of Hamburg):

Case study
07 June 2016

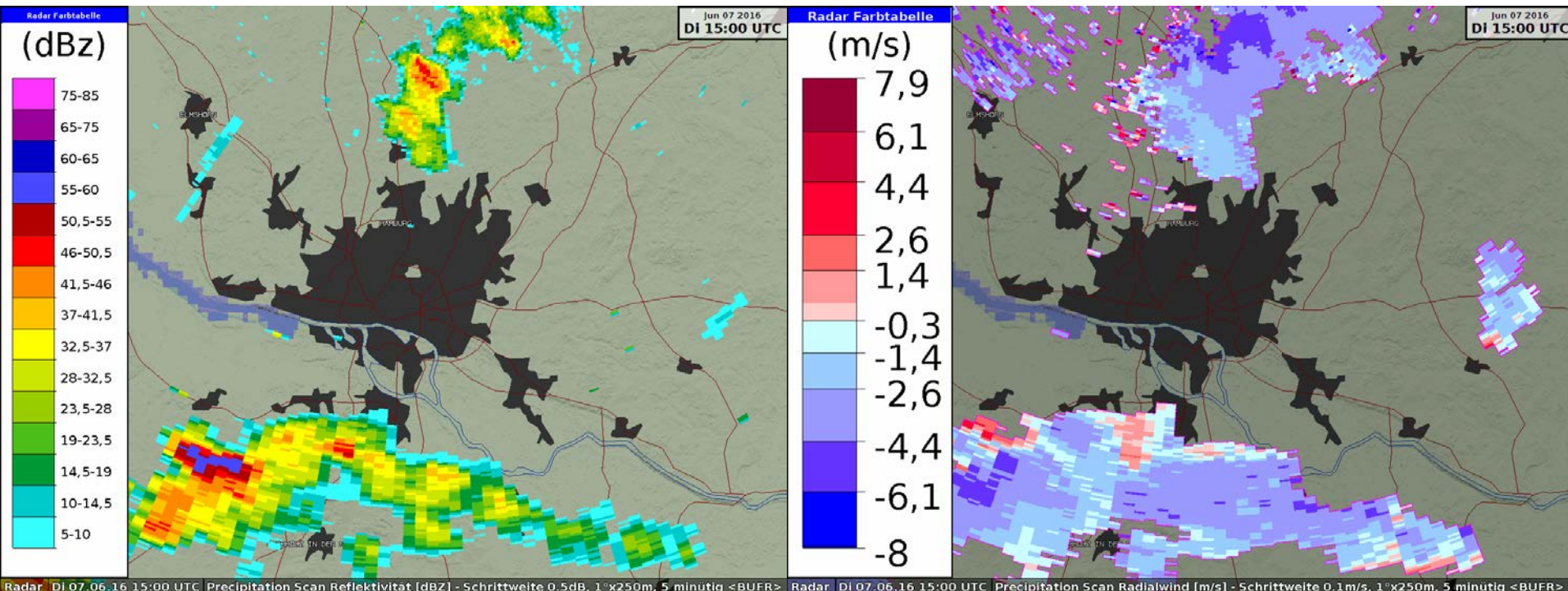


➤ *RADAR* products (summer)



heavy precipitation event including tornadoes
above Northern Germany (city of Hamburg):

Case study
07 June 2016



radar reflectivity

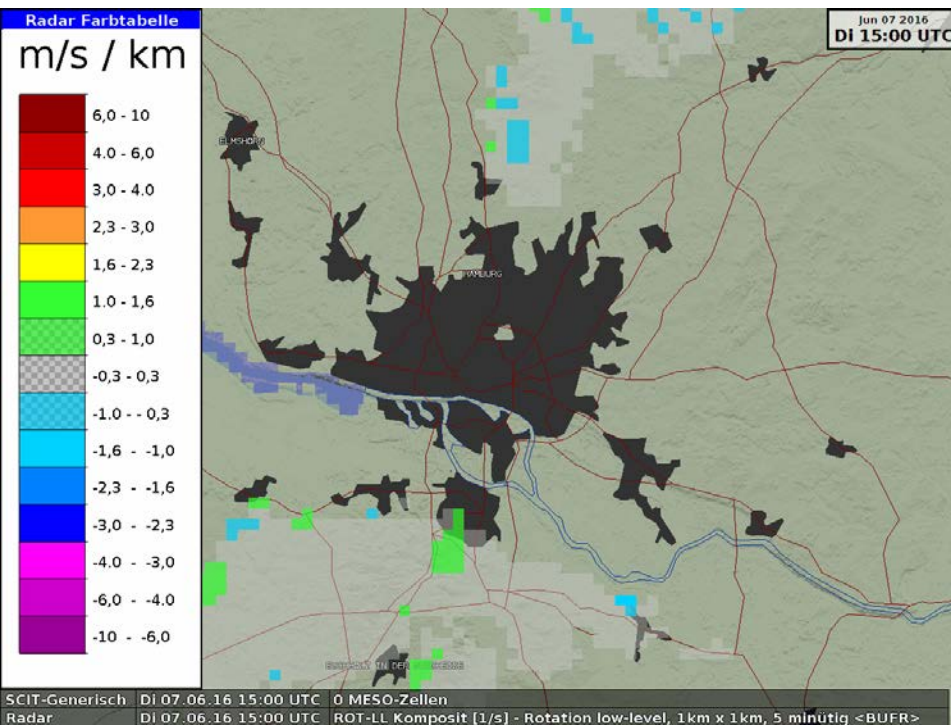
radar radial wind velocity

➤ *RADAR* products (summer)

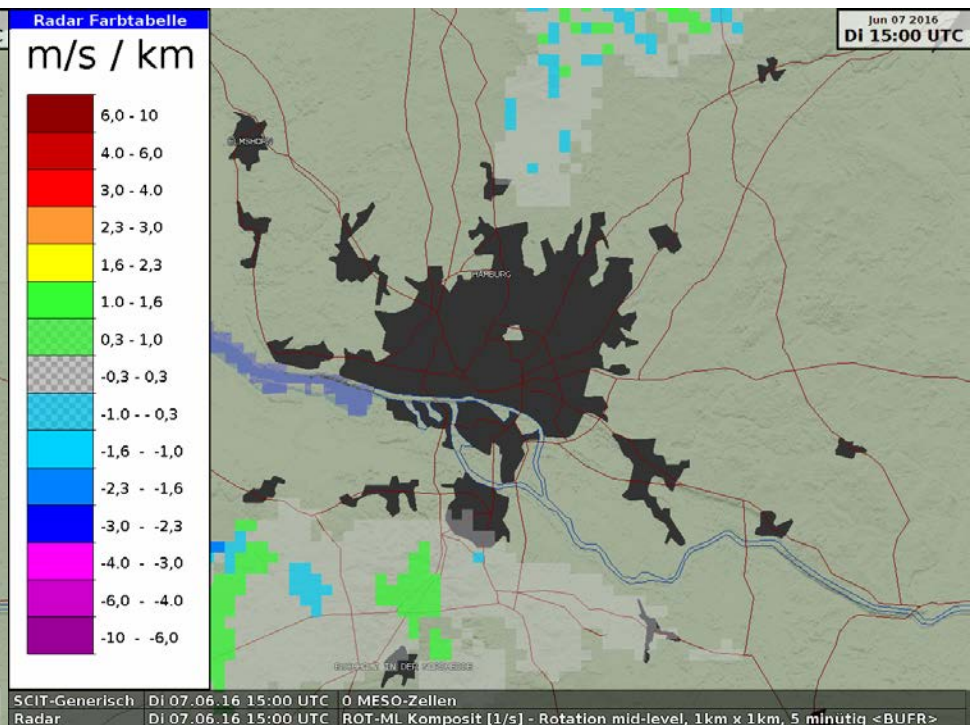


heavy precipitation event including tornadoes
above Northern Germany (city of Hamburg):

Case study
07 June 2016



low level (z=0-3 km) rotation signals



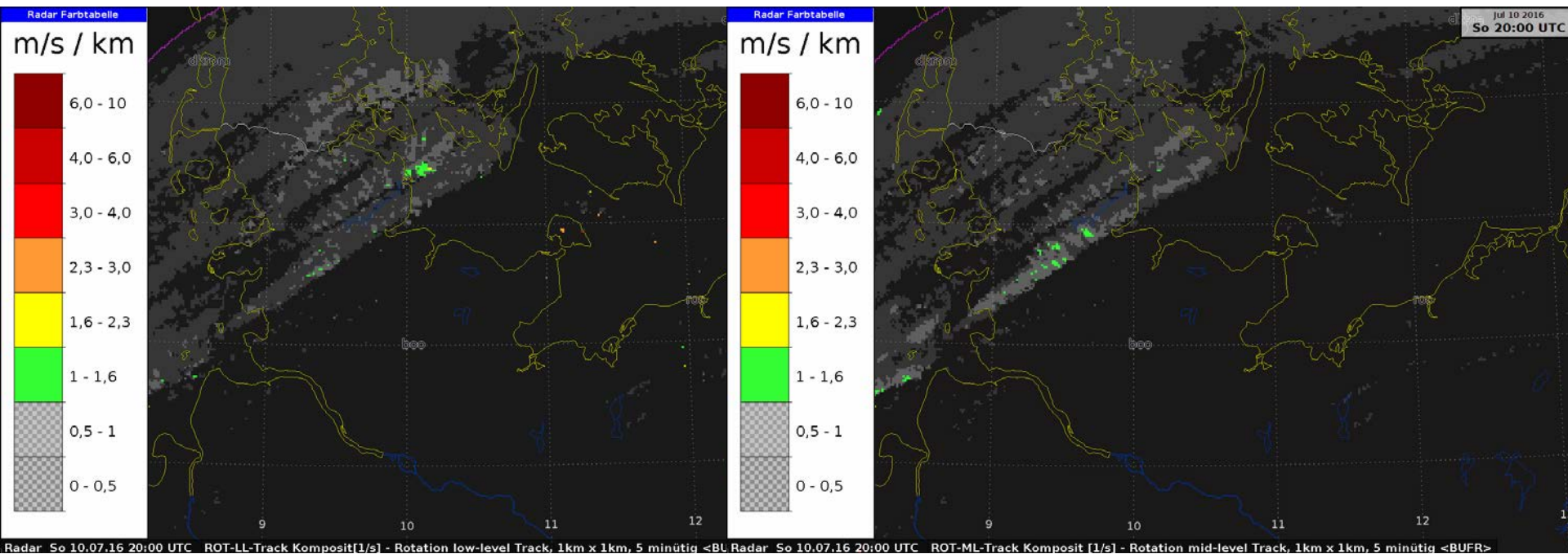
mid-level (z=3-6 km) rotation signals

➤ *RADAR* products (summer)



heavy precipitation event including rotation signals
above Northern Germany:

Case study
10 June 2016



low level (z=0-3 km) rotation signals

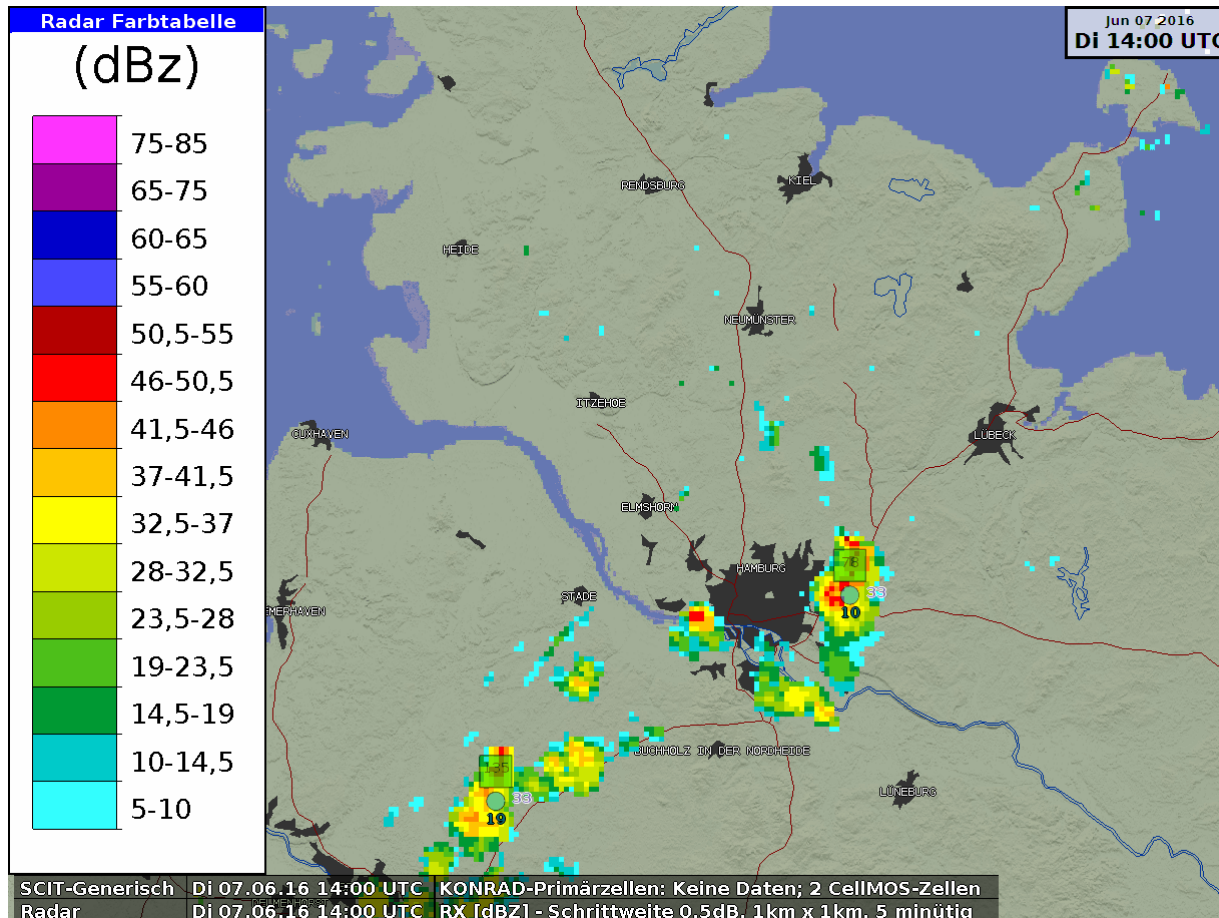
mid-level (z=3-6 km) rotation signals

➤ *RADAR* products (summer)



heavy precipitation event including tornadoes
above Northern Germany (city of Hamburg):

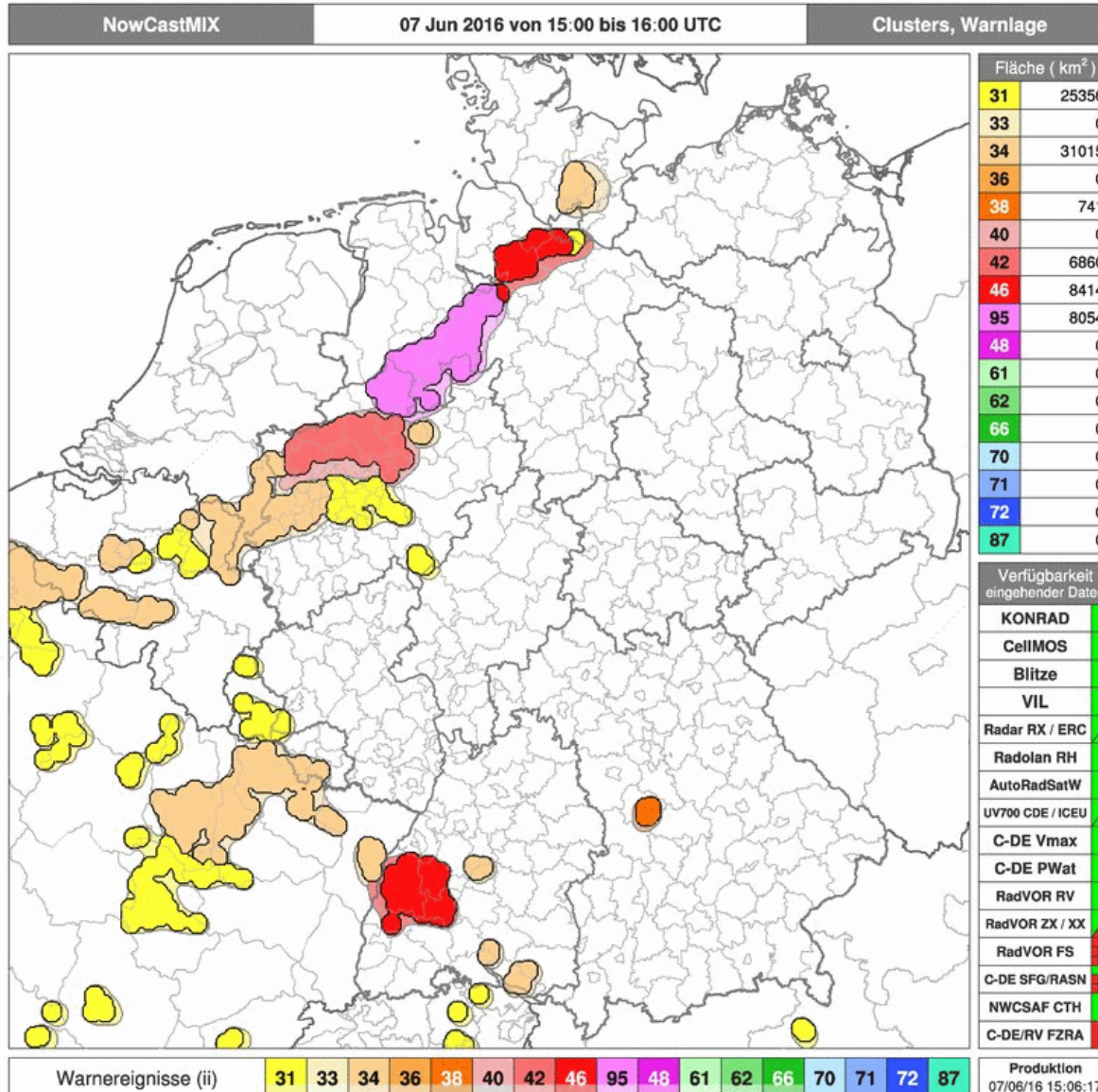
Case study
07 June 2016



Visualisation of:

- radar reflectivity
- KONRAD cells
- CellMOS cells

➤ Weather warnings



Case study
07 June 2016

heavy precipitation event
including tornadoes
above Northern Germany
(city of Hamburg)

visualisation of
warning areas (forecast +1h)
by **NowCastMIX**
(fuzzy logic system)
→ basis for official warnings

➤ Weather warnings



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DWD uses different ways to distribute official weather warnings:

- telefax
- SMS
- app:

www.dwd.de/warnwetter

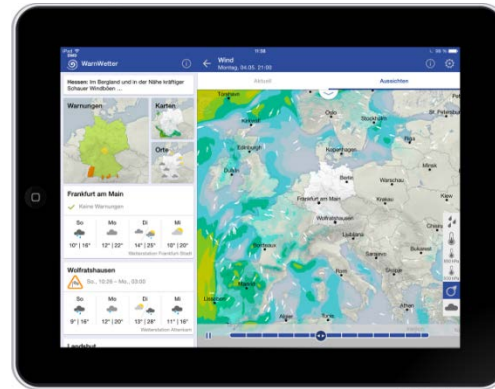
- overview about current warning situation in Germany
- detailed information about local situation
→ official warnings and trends
→ GPS warnings
- configurable warning elements and alarm levels



➤ Weather warnings



WarnWetter- App of DWD:



currently 2.700.000 users



- current **satellite** images in high resolution (RSS)
- DWD weather **radar** data
- **predicted tracks** of storm cells
- localised **forecasts** and current **observations**
- **model forecasts** which are relevant for warnings
→ storms, heavy precipitation
- **video clips** in case of heavy weather events
- **traffic** information (google)

➤ Weather warnings



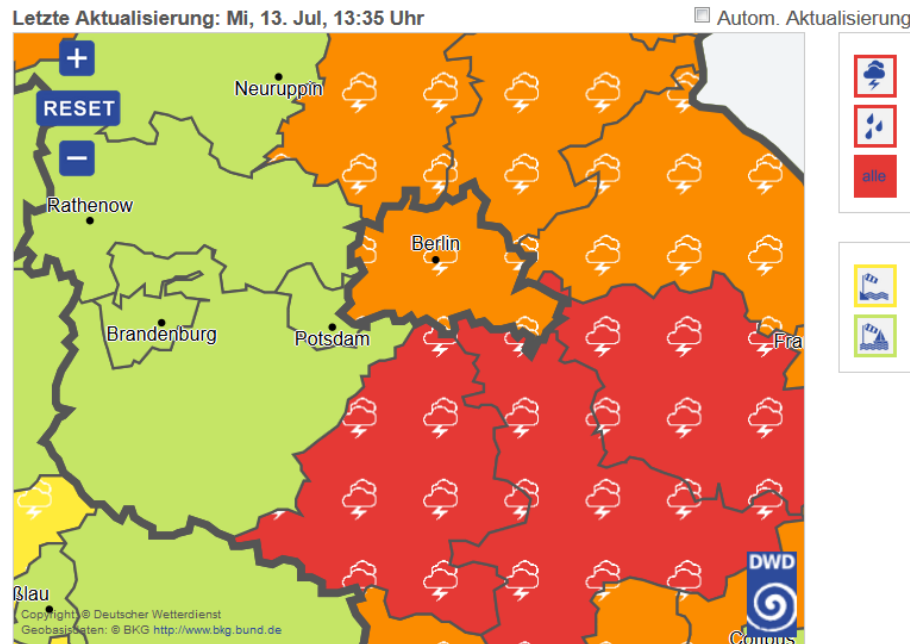
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NEW:

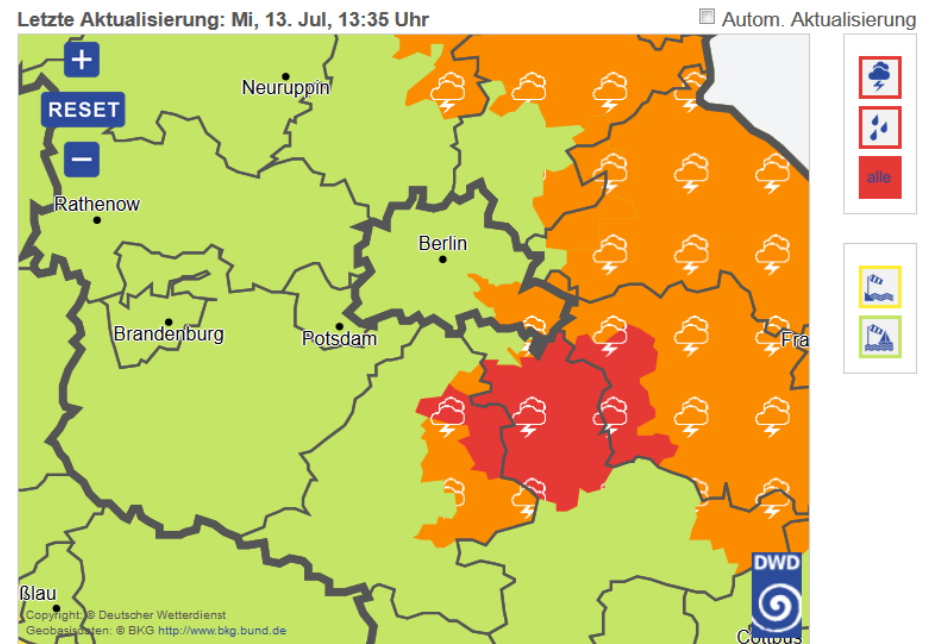
until 14 July 2016:

warnings for rural districts (Landkreis)



since 14 July 2016:

warnings for communities and urban districts (Stadtbezirk)





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Thank you !

多謝

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