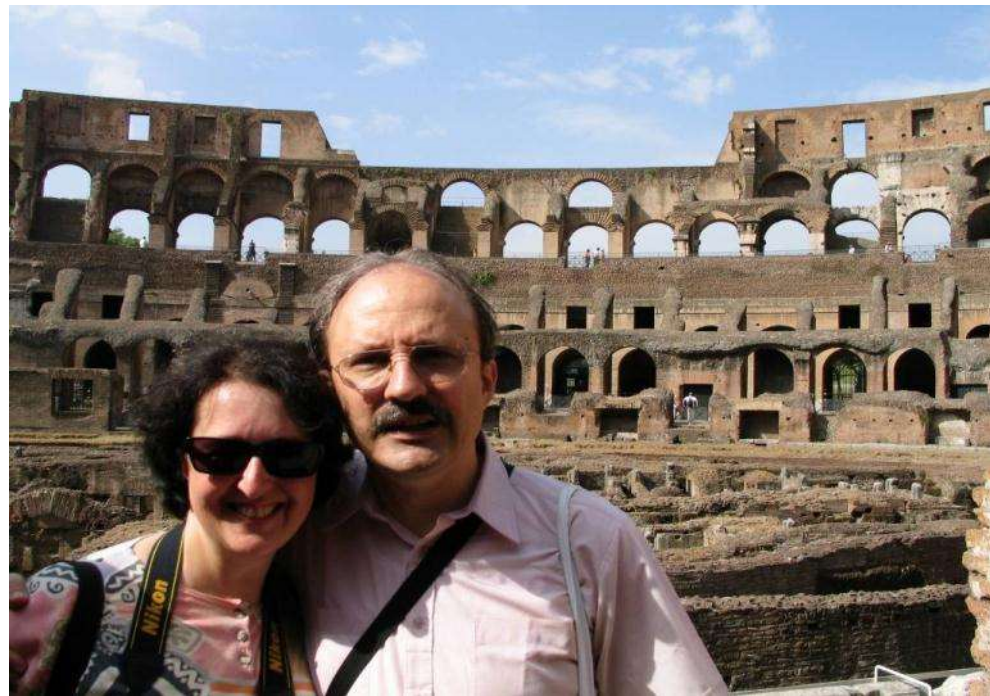


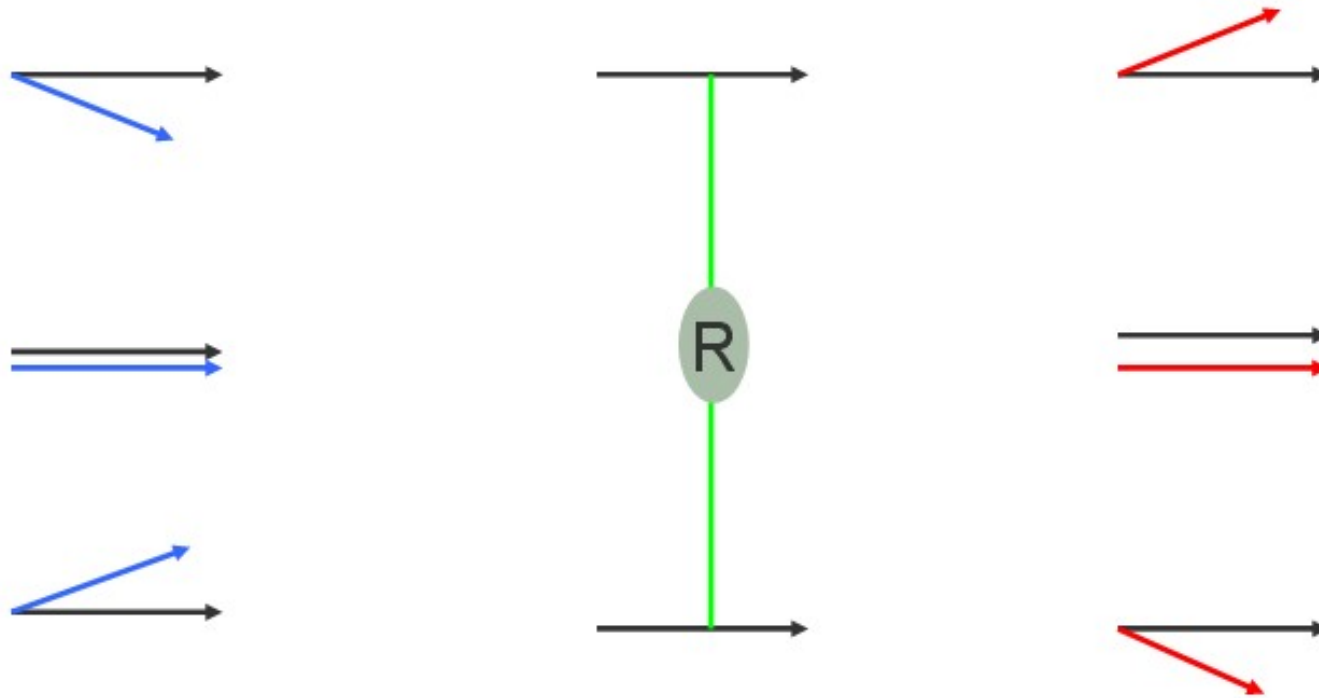
# Welcome to "Wind from radar (Doppler)"

Wilfried Jacobs  
Training Center of DWD  
wilfried.jacobs@dwd.de

- Basics of interpretation
  - Radial wind component
  - CAPPI
  - PPI
- Typical patterns and examples
- Automatic product "Mesocyclone" at DWD

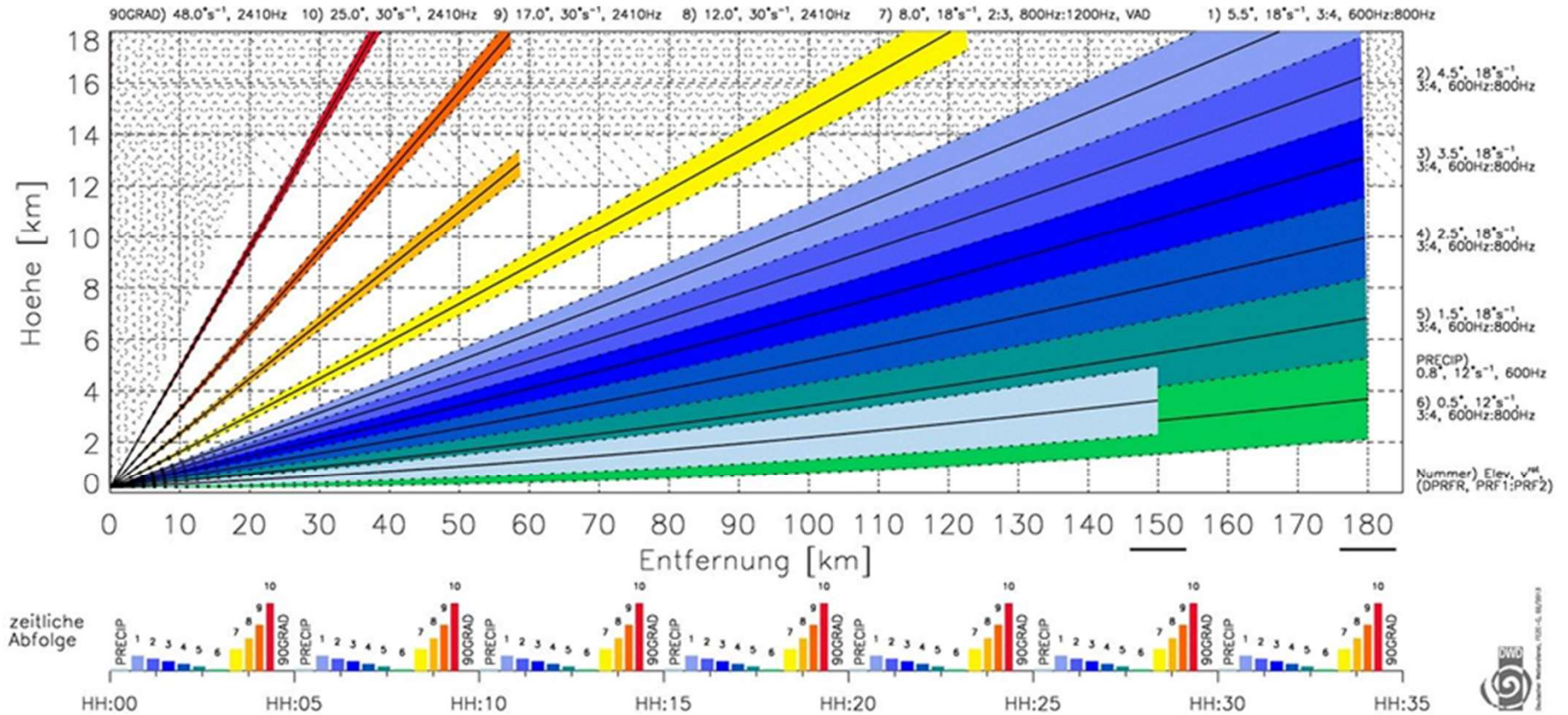


## Derivation of radial winds (homogenous wind field)



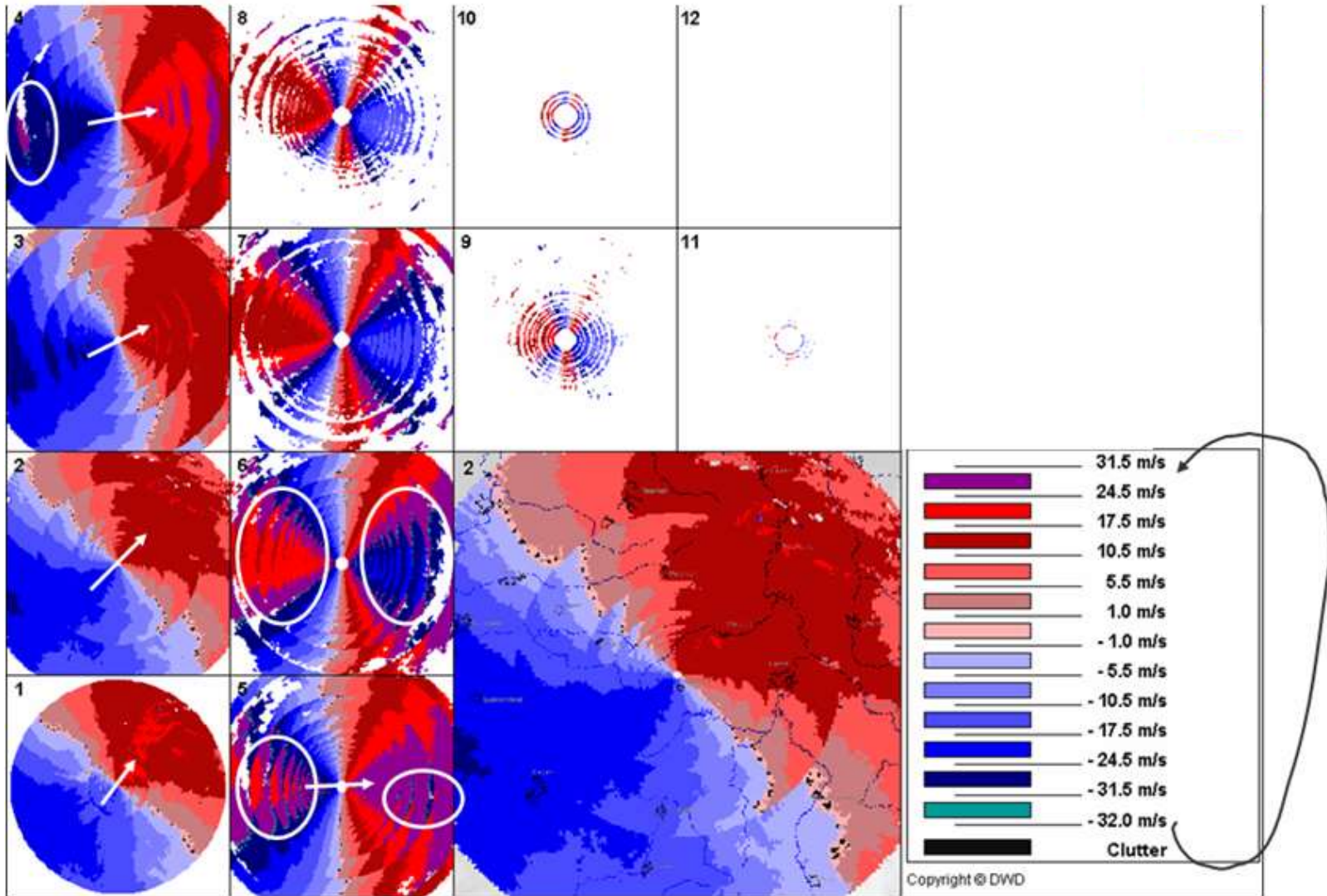
Real speed and direction of wind can be only derived in areas of two overlapping radar domains.

# Scan strategy at DWD

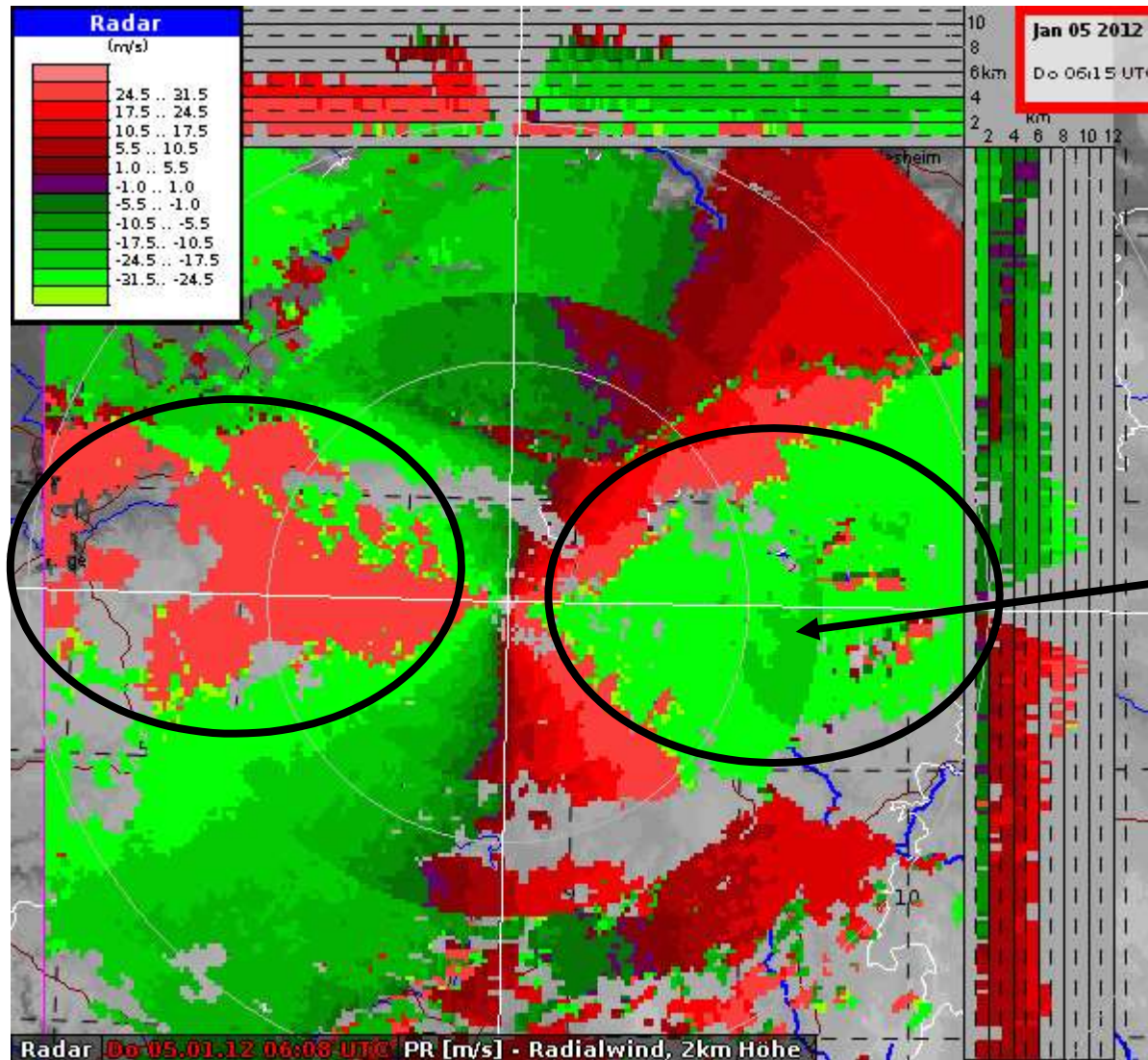


# Warm air advection and folding

## CAPPI (Constant Altitude Plan Position Indicator)



# 05.01.2012, 06:15 UTC: Doppler near Frankfurt (2 km) – CAPPI (Constant Altitude Plan Position Indicator)

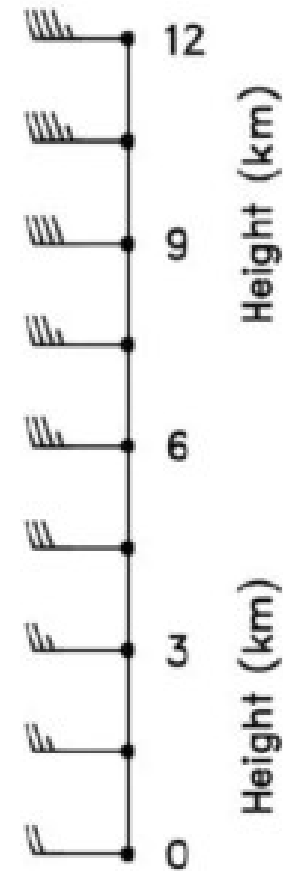
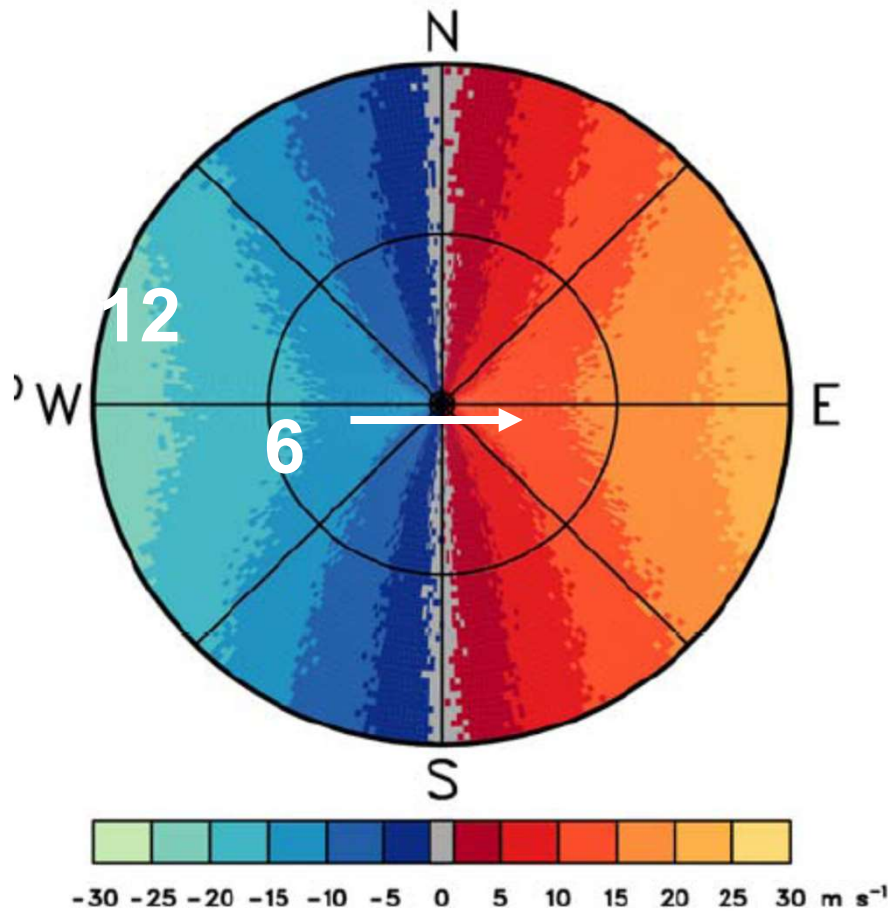


Ellipses:  
Folding

Radial wind  
speed up to  
 $32 + (32 - 17,5) =$   
 $+ 46,5 \text{ m/s}$

# Doppler velocity image and corresponding “temp”

PPI (Plan Position Indicator)

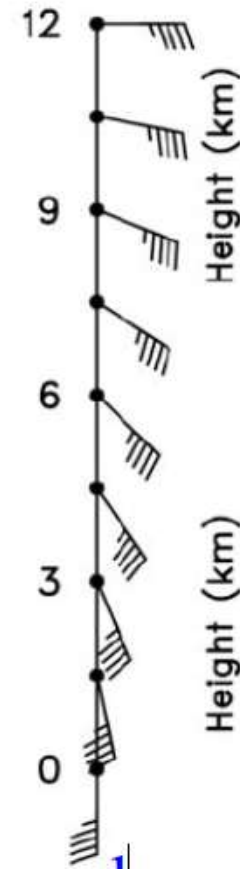
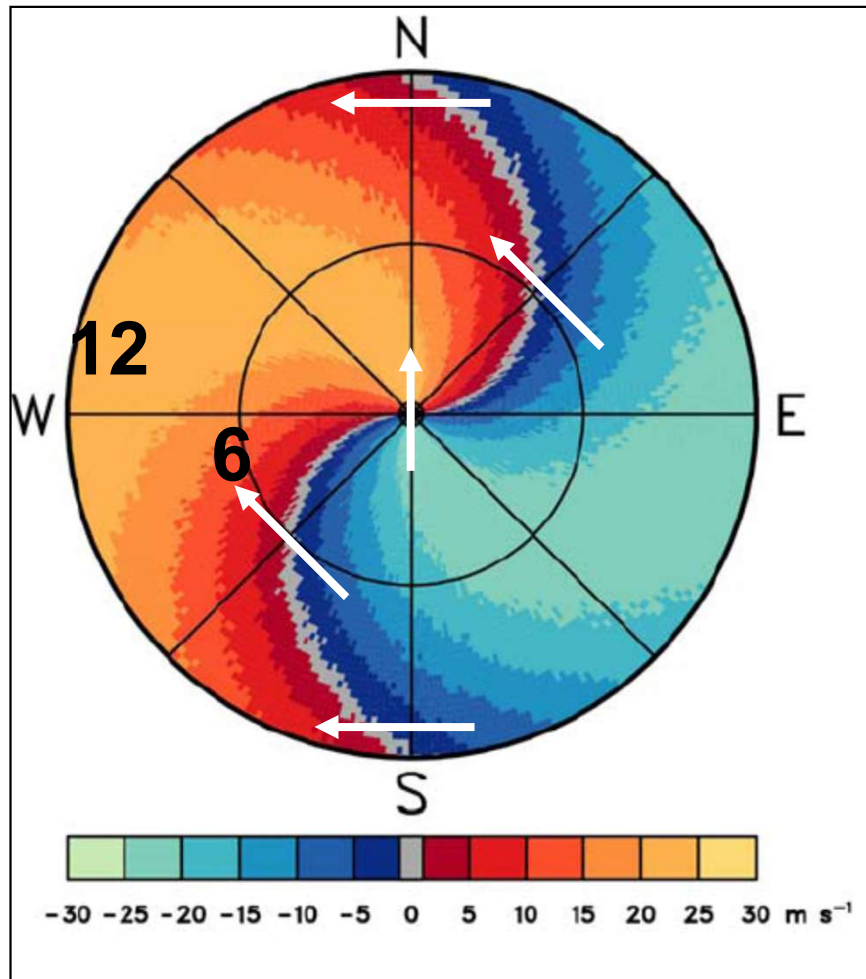


Idea: S. Burcea, Romania

Note: wind barbs displayed in knots;  
Doppler Velocity images are displayed in  
m/s  
1kt ~ 0.5 m/s

# Doppler velocity image and corresponding “temp”

PPI (Plan Position Indicator)

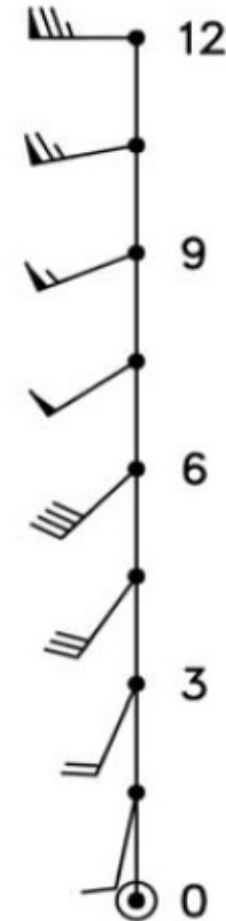
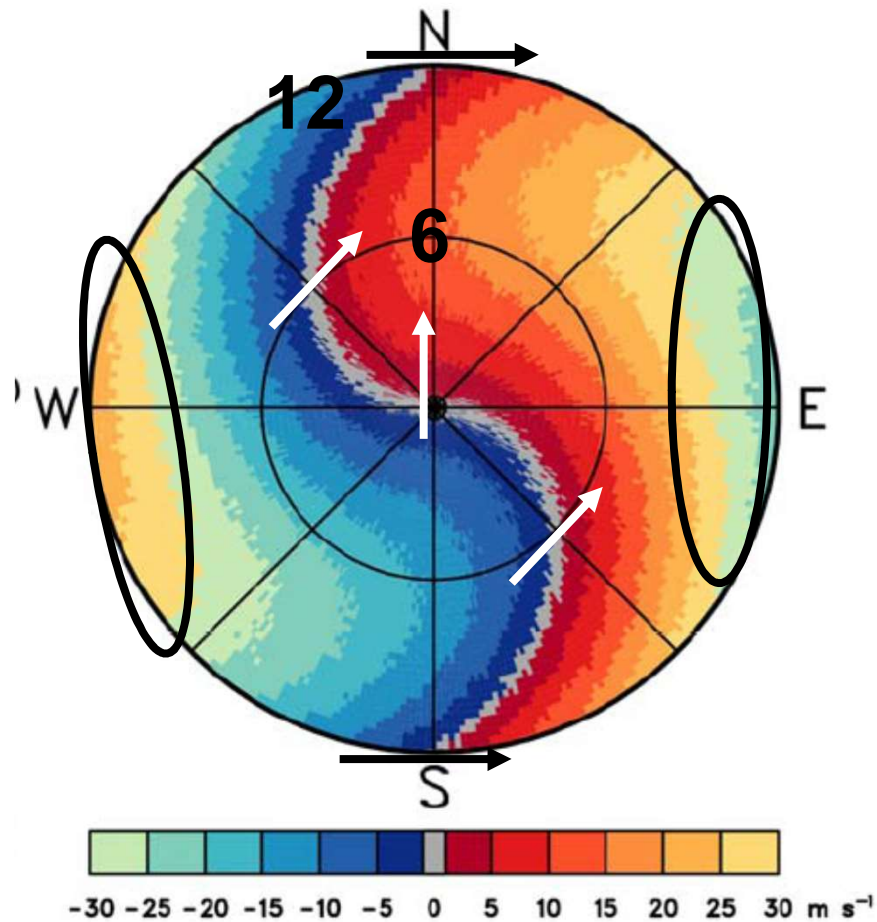


Idea: S. Burcea, Romania

Note: wind barbs displayed in knots;  
Doppler Velocity images are displayed in  
m/s  
1kt ~ 0.5 m/s

# Doppler velocity image and corresponding “temp”-Folding!

PPI (Plan Position Indicator)

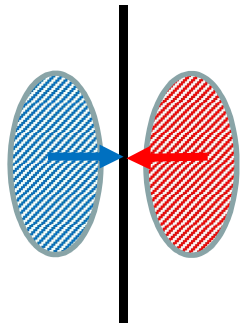


Note: wind barbs displayed in knots;  
Doppler Velocity images are displayed in  
m/s  
1kt ~ 0.5 m/s

Idea: S. Burcea, Romania

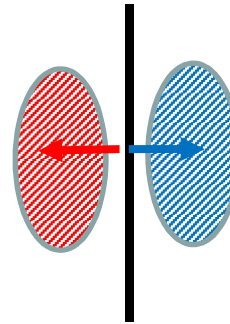


# Typical patterns in Doppler-radar products



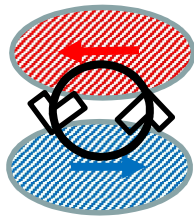
R

Convergence



R

Divergence



R

Rotation  
(Diameter < 20 km)

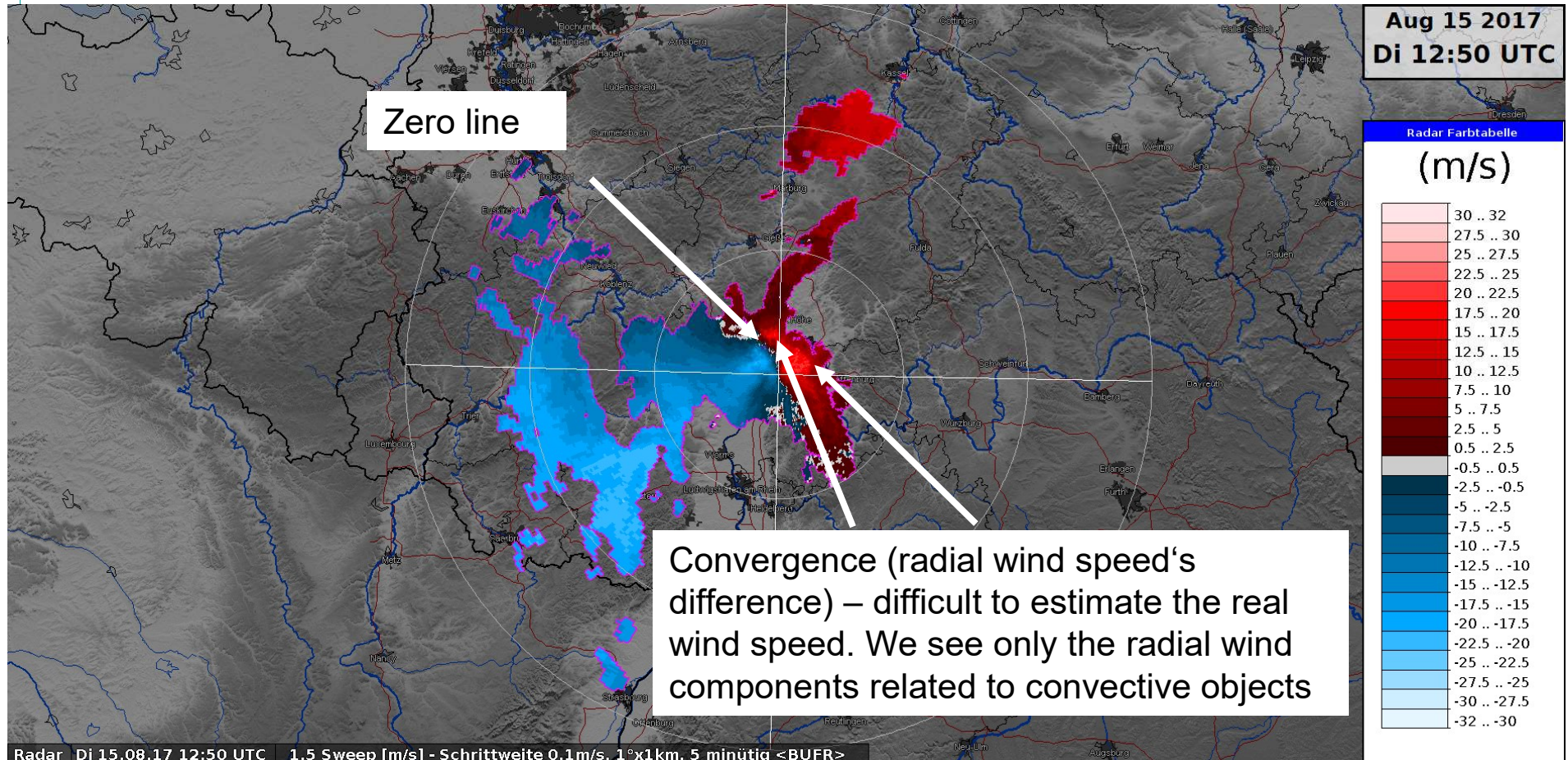
Notice:

Also velocity differences are hints for convergences/divergences. That means that switches of colours are not the only precondition for convergences/divergences.

Also the motion of the entire system should be taken into account.

# Squall line – 15 August 2017, 12 :50 UTC

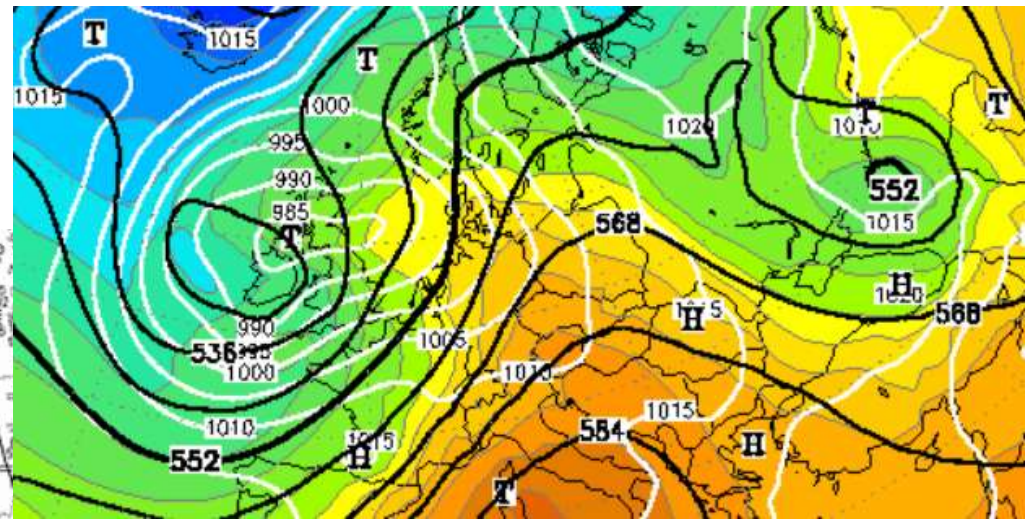
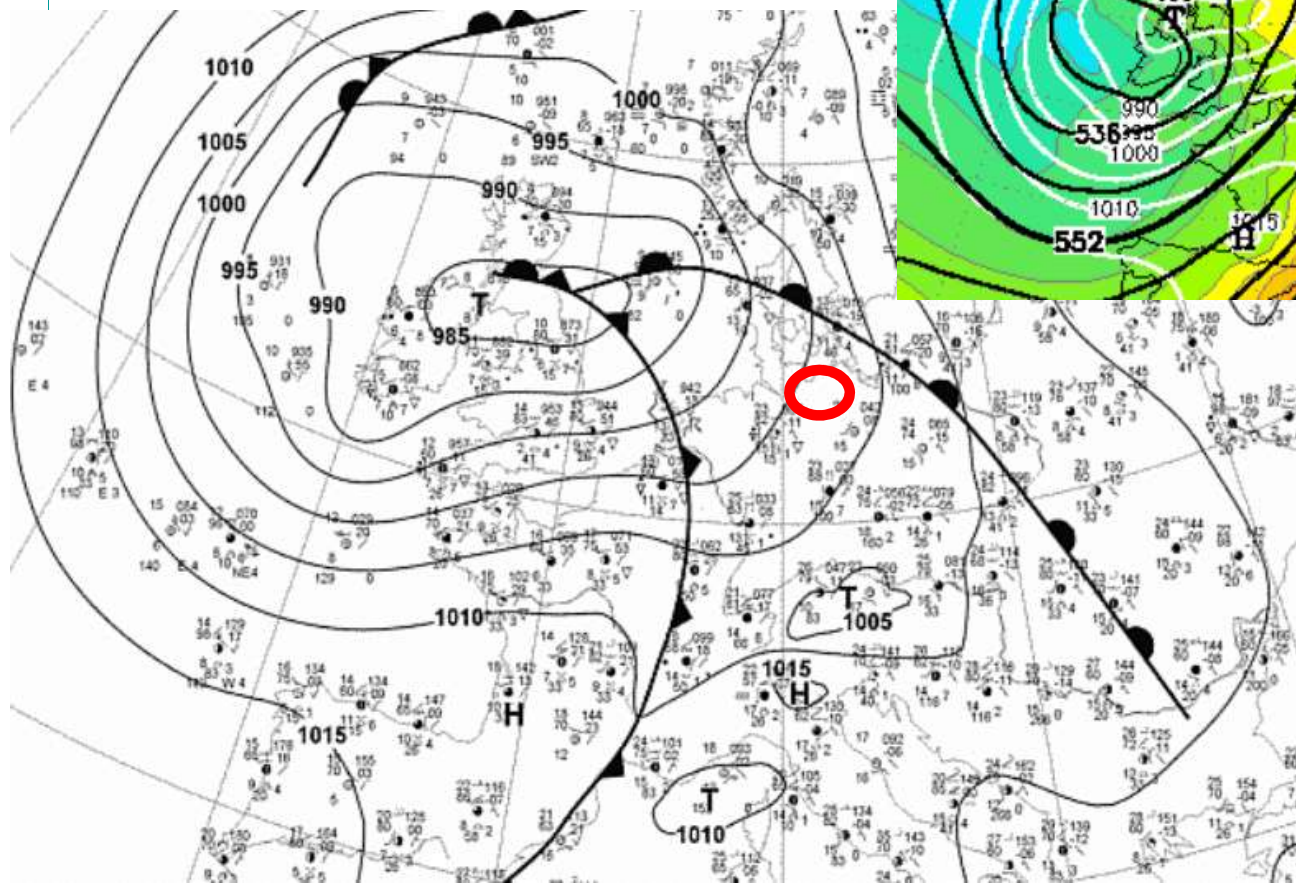
PPI (Plan Position Indicator) – Sweep: 1,5°



Just after the squall line's passage at Offenthal (near Langen, 3 trees tumbled.)

# 05-05-2015, 12 UTC – F3-tornado (afternoon)

Surface analysis



GFS-analysis: ps, geop  
500,  
Rel top 500/1000

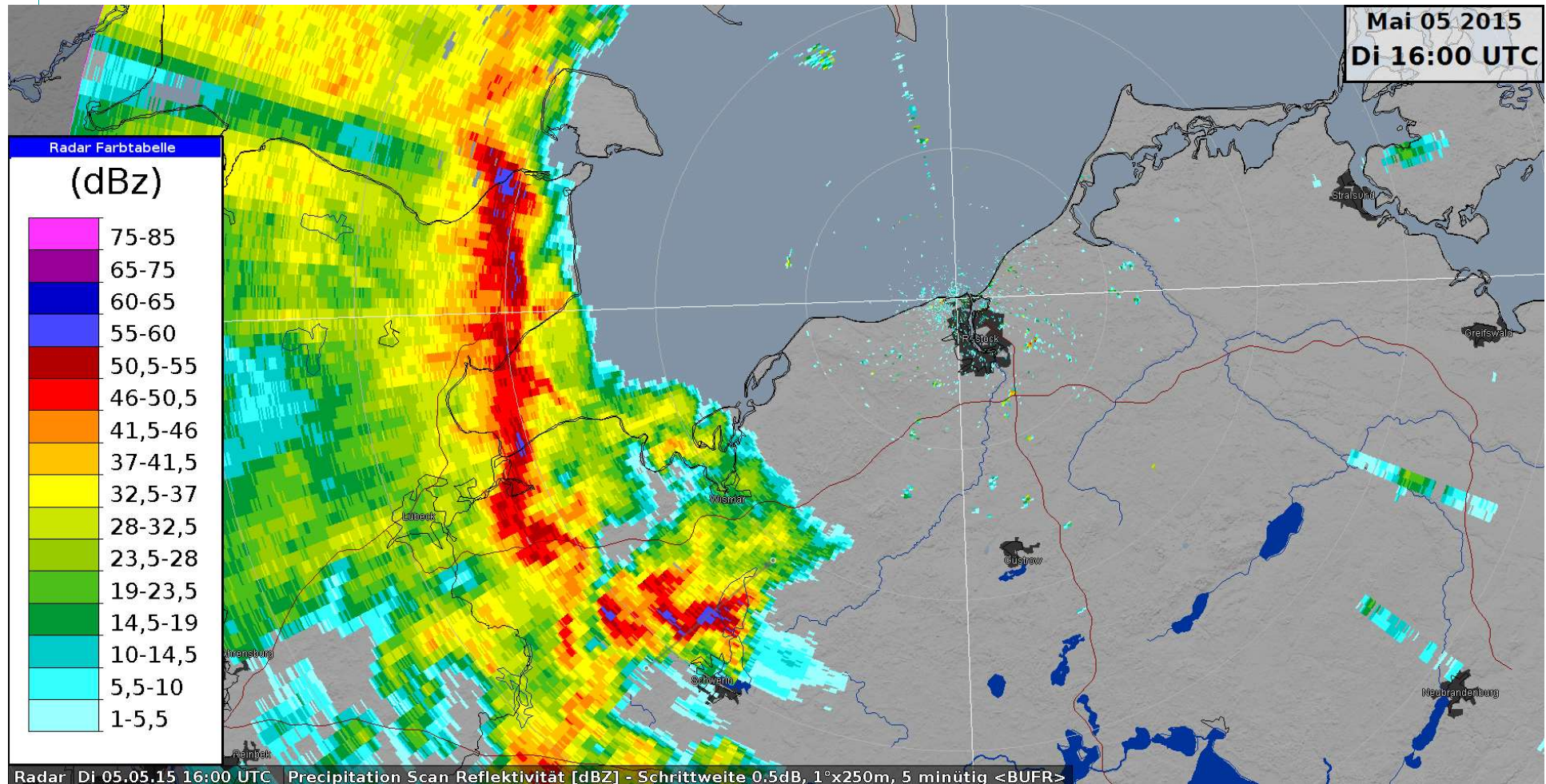
[http://www.wetter24.de/uploads/tx\\_news/612/11056432\\_10152940503506379\\_7677559799270767557\\_n.jpg](http://www.wetter24.de/uploads/tx_news/612/11056432_10152940503506379_7677559799270767557_n.jpg)



[http://www.wetter24.de/uploads/tx\\_news/612/IMG-20150505-WA0052\\_Cropped.jpg](http://www.wetter24.de/uploads/tx_news/612/IMG-20150505-WA0052_Cropped.jpg)



# 05-05-2015, 16:00 UTC: Precipitation Scan (250 m) (Rostock)



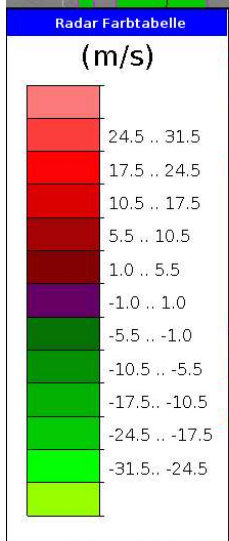
# 05-05-2015, 16:00 UTC: PPI - Doppler, Sweep 1.5° (Rostock)

Mai 05 2015  
Di 16:00 UTC

Altitude about 2 km, maximum wind: +28 m/s (folding!).

→ Radial wind  $-32 - (32-28) = -36$  m/s

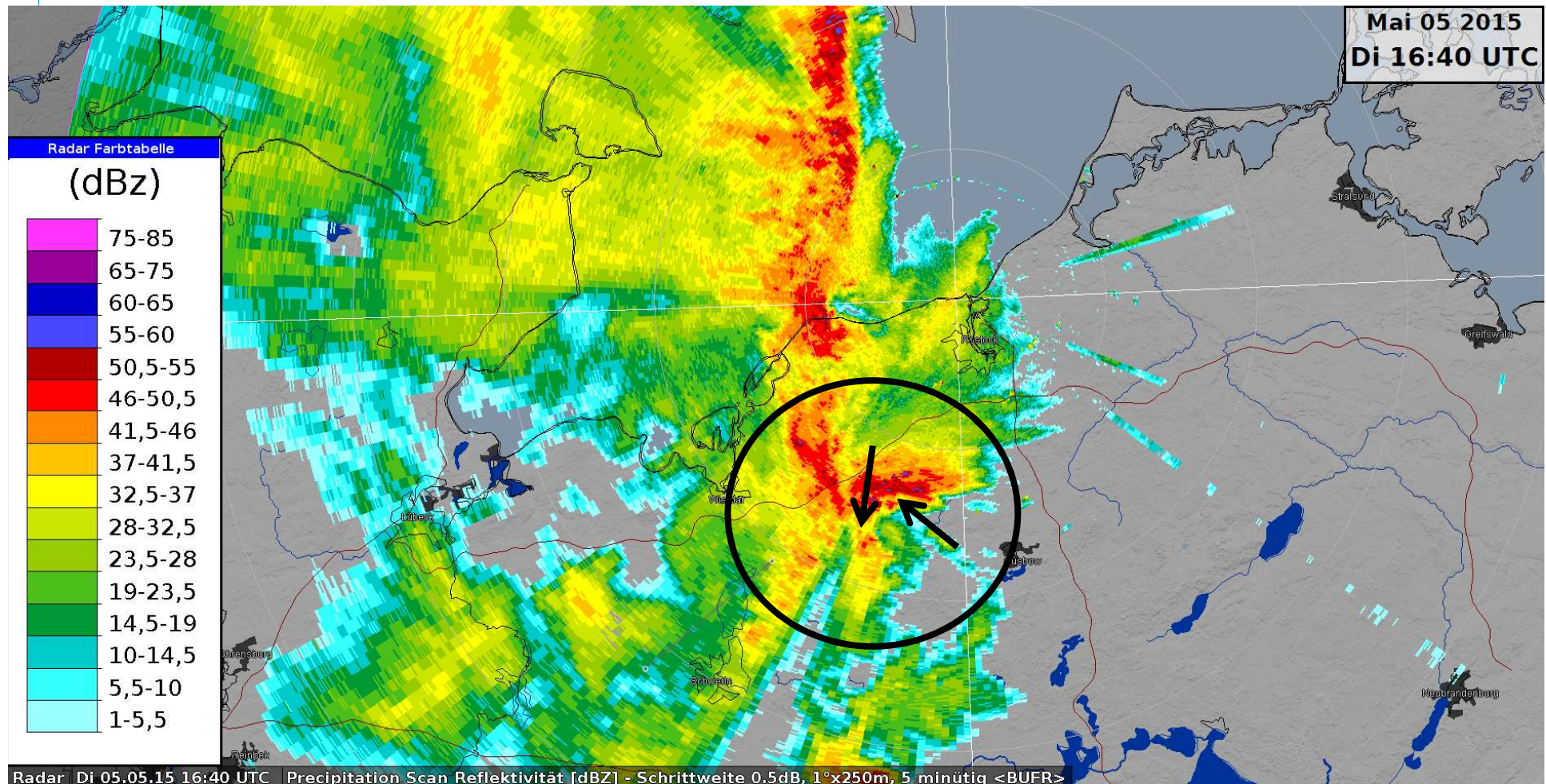
→ Gusts up about 70 kt possible (potential instability)



Altitude about 1 km, Insects (**weak** warm air advection)

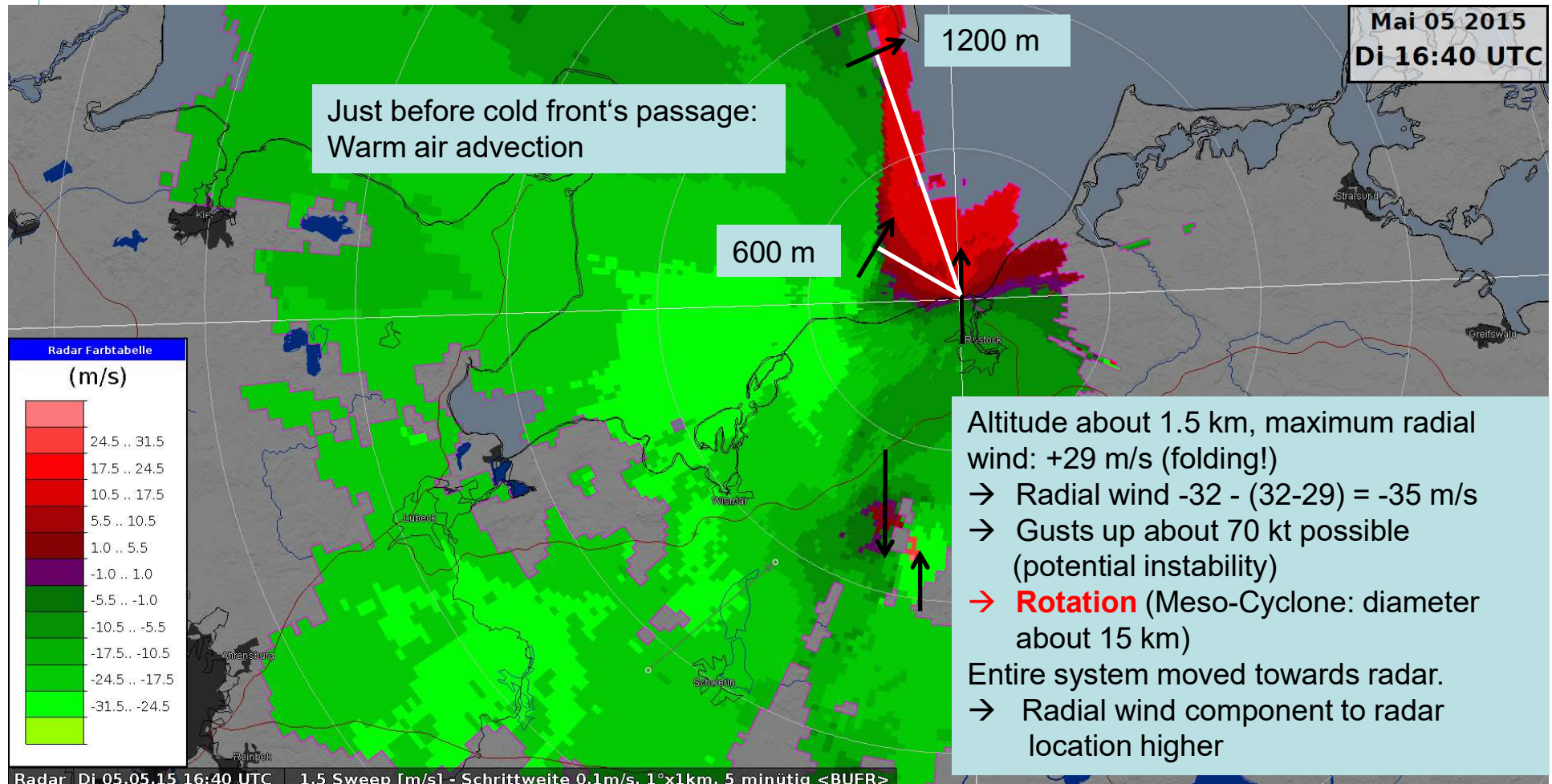
Radar | Di 05.05.15 16:00 UTC | 1.5 Sweep [m/s] - Schrittweite 0.1m/s, 1°x1km, 5 minütig <BUFR>

# 05-05-2015, 16:40 UTC: Precipitation Scan (250 m) (Rostock)

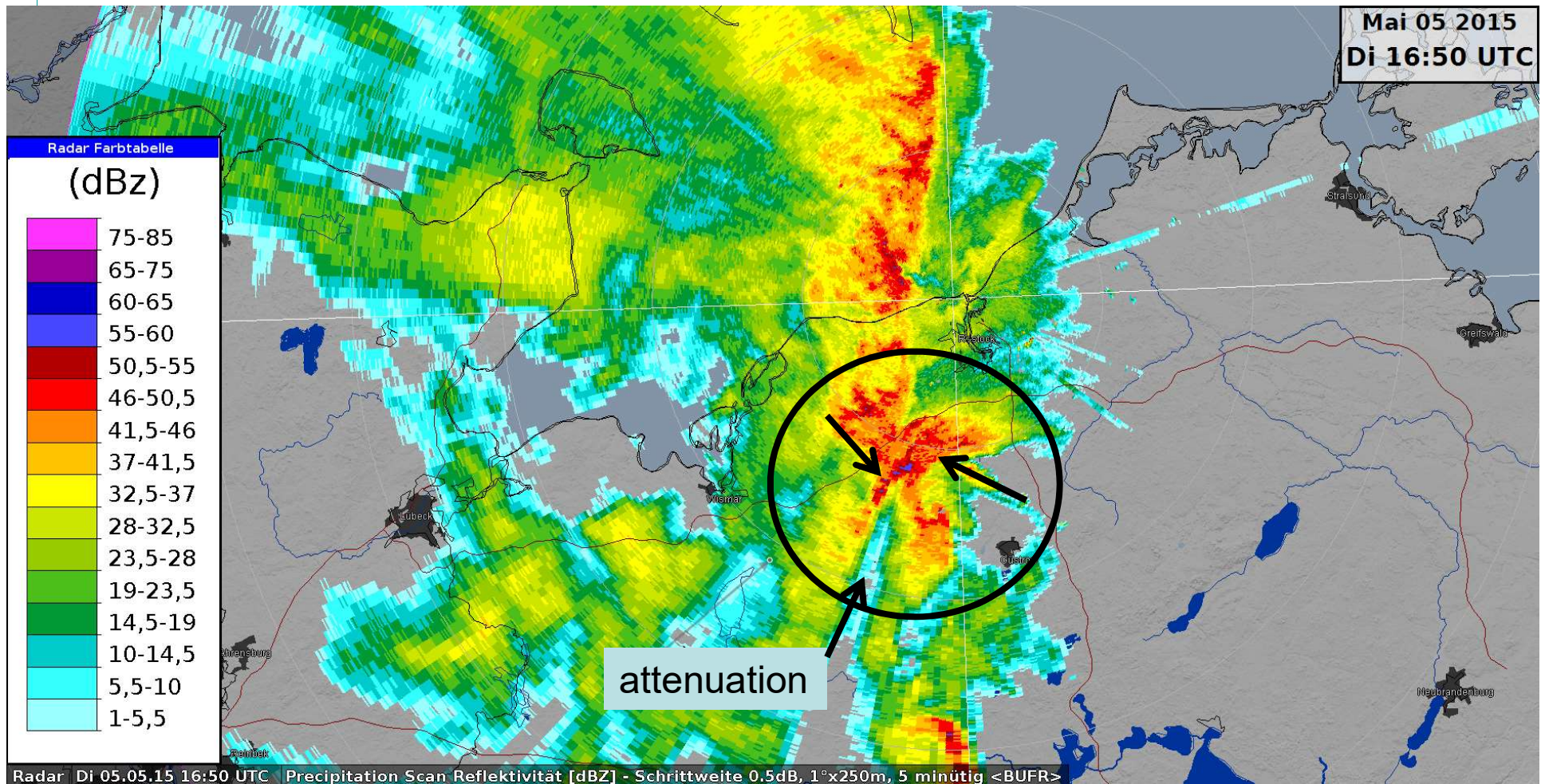




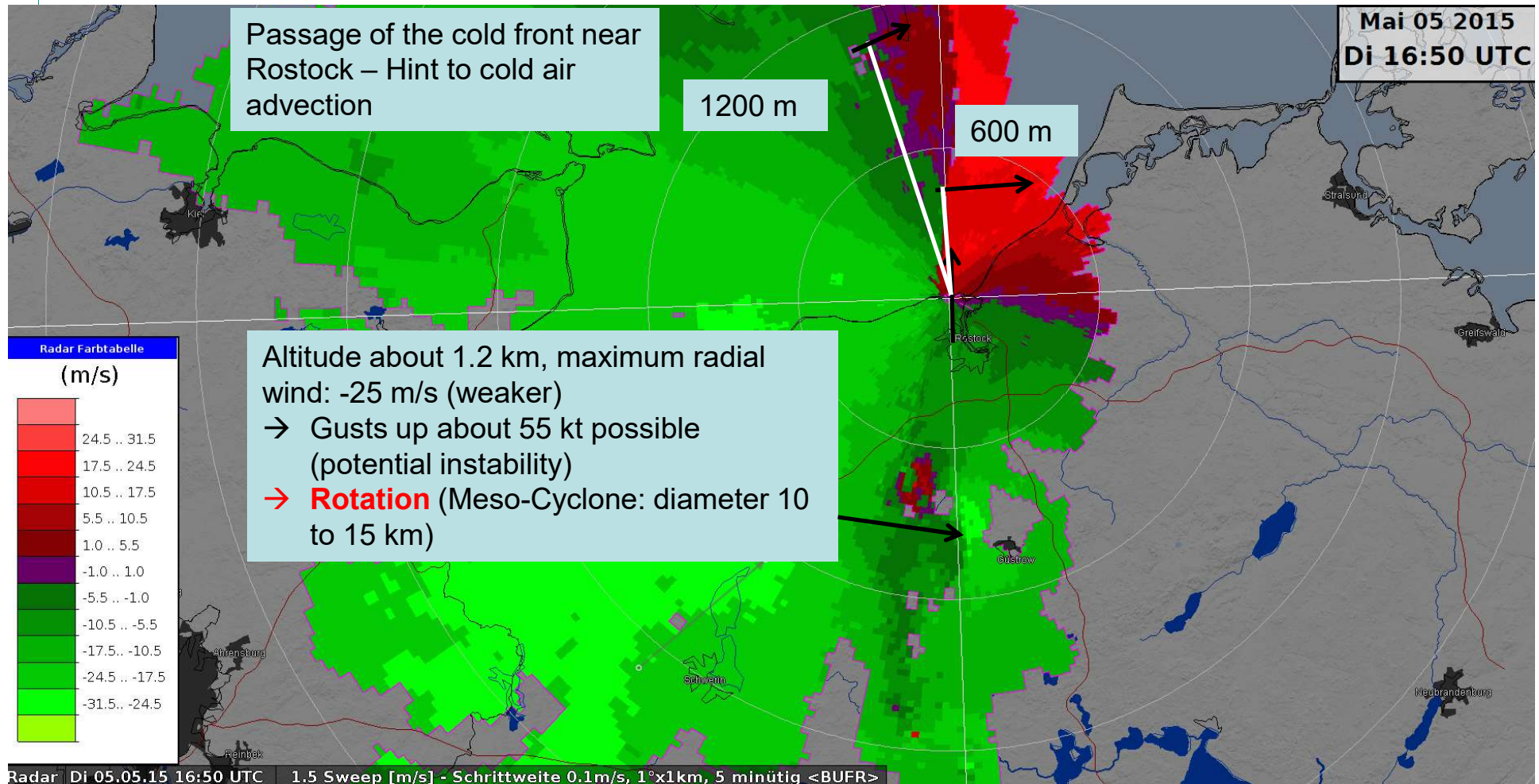
# 05-05-2015, 16:40 UTC: PPI - Doppler, Sweep 1.5° (Rostock)



# 05-05-2015, 16:50 UTC: Precipitation Scan (250 m) (Rostock)



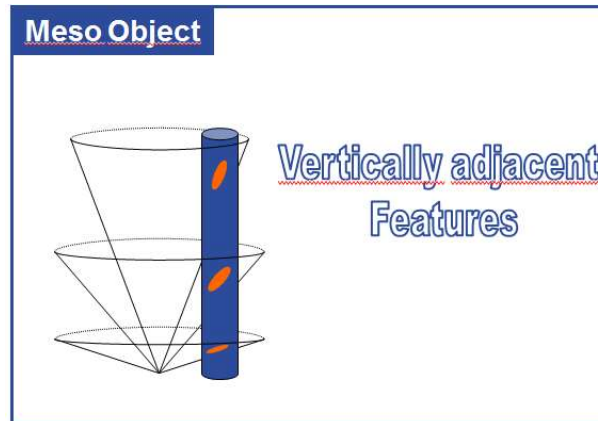
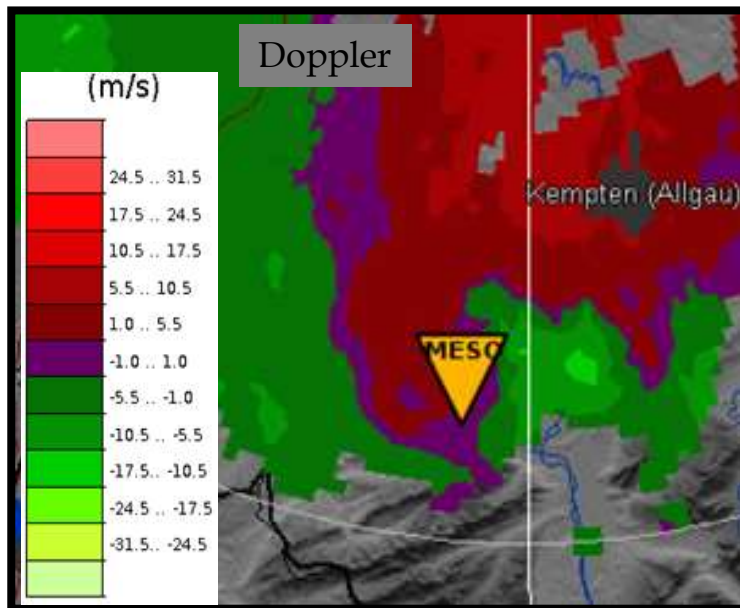
# 05-05-2015, 16:50 UTC: PPI - Doppler, Sweep 1.5° (Rostock)



## Mesoscale Detection Algorithm (MDA)



Detecting mesocyclones from 3-D-Doppler-products



- Identification of patterns (z.B. Rotationen) **pattern vectors**
- Patterns' grouping **features**
- Defining meso-objects

(Thomas Hengstebeck, DWD)

NinJo-Visualisation of

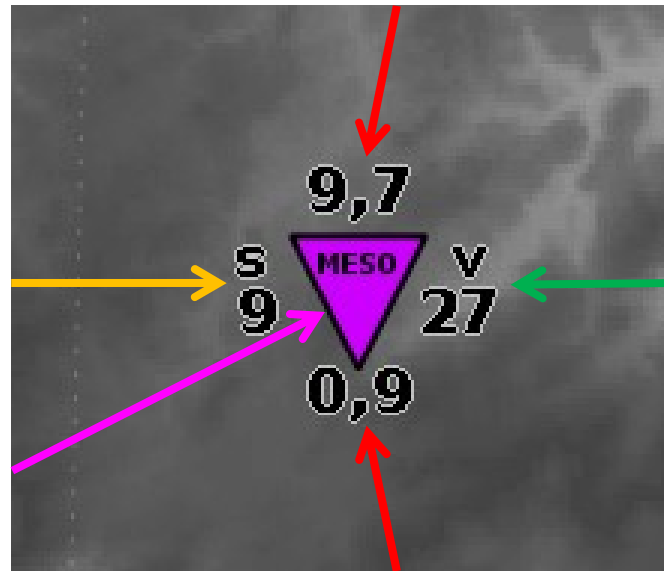
## **Mesocyclones**

Top of mesocyclone [km]  
(Source can be one of adjacent radar locations)

Maximum wind shear [m/s/km]

Maximum rotation velocity [m/s]  
of the 3D-object „mesocyclone“

Severity of the 3D-object „mesocyclone“

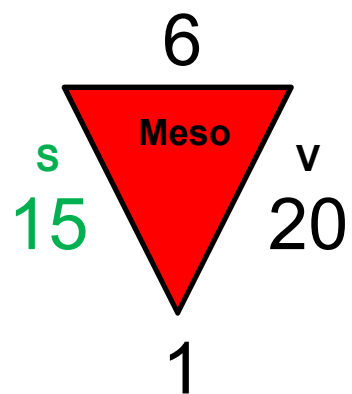


Bottom of mesocyclone [km]

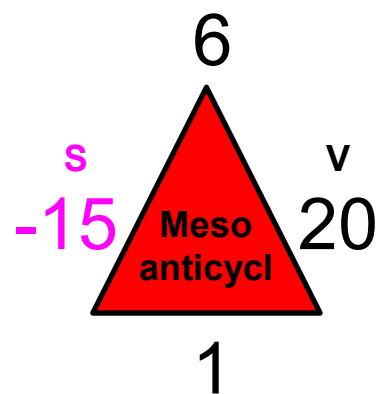
*Mesozyklonen*

---

Symbol  
Meso-cyclone



Symbol  
Meso-anticyclone

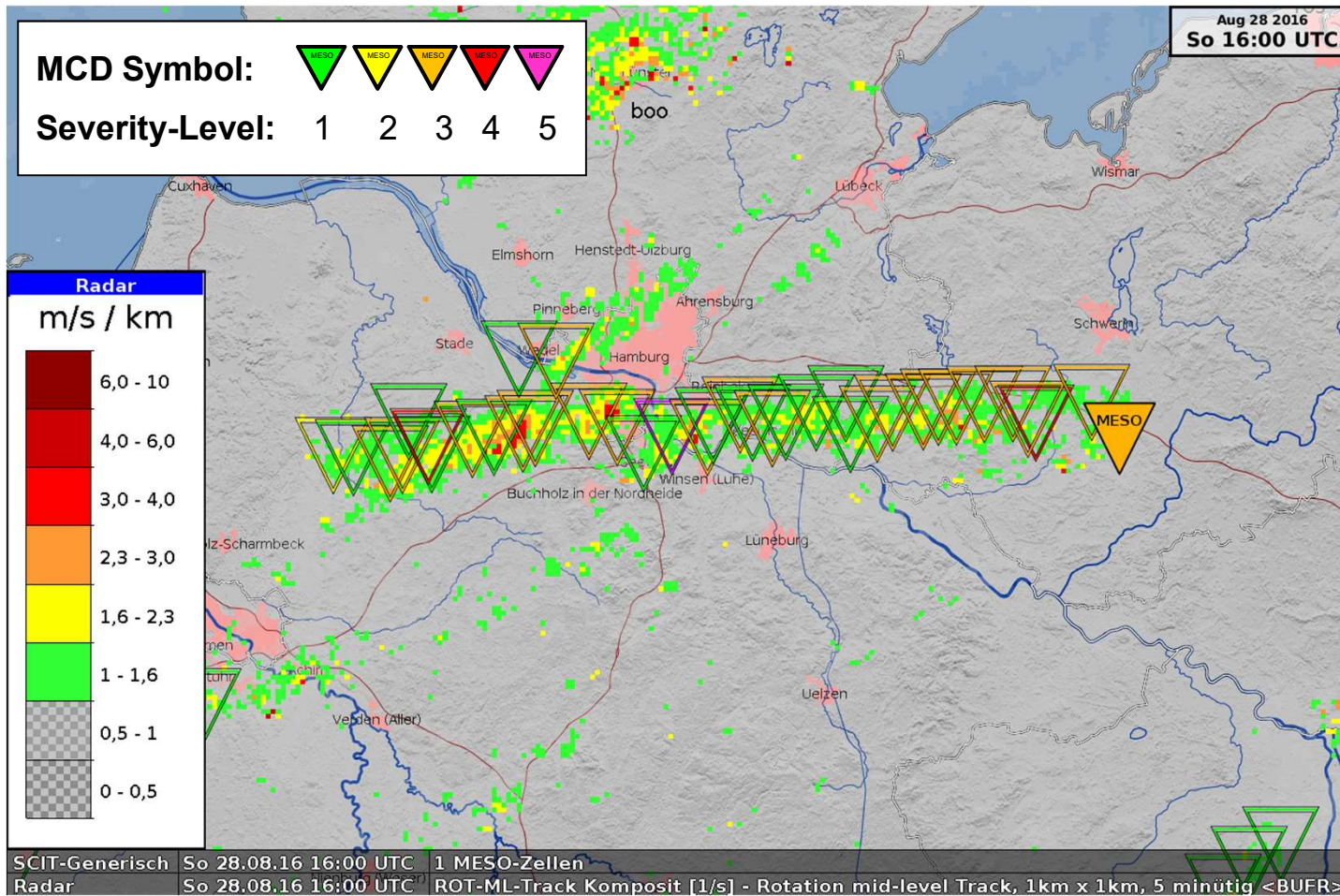


Neuer Algorithmus und Symbole der **Mesozyklonen**

**T. Boehme (DWD)**

Attributes object „mesocyclone“			Level of severity				
			1	2	3	4	5
<b>Reflectivity</b>	<i>Maximum reflectivity [dBZ]</i>	≥	10	30	40	50	55
	<i>Mean reflectivity [dBZ]</i>	≥	10	20	25	35	40
	<i>Echo top [km]</i>	>	2	5	10	20	30
	<i>Vertically integrated liquid water (VIL) [kg m<sup>-2</sup>]</i>	>	1	3	4	5	7
	<i>VIL density [g cm<sup>-3</sup>]</i>	>	0	1	1,5	2	2,5
<b>Geometry</b>	<i>Number of rotation patterns</i>	≥	1				
	<i>Lowest signal [km]</i>	≤	5	3	2,5	2	1,5
	<i>Horizontal diameter [km]</i>	≥	---				
	<i>Vertical mesocyclone's extension [km]</i>	>	0	0	2	4	6
<b>Rotation intensity</b>	<i>Maximum rotation velocity [m/s]</i>	>	---				
	<i>Amount of maximum impulse [m/s * km]</i>	>	0	0	0	15	20
	<i>Amount of maximum wind sheer [m/s /km]</i>	>	0	0	0	150	200

## 2016-08-28 16:00 UTC Mid-Level-Rotation (3-6 km)+ Mesozyclone Detection (MCD) (with 3h-history)





# Rotationsprodukte

