Wilfried Jacobs (DWD): Convective line – no convective line?

1. Briefly: Theoretical background
2. Typical features (Emma: Feb/March 2008)
3. Two succeeding winter storms
    a. 03 January 2012: No convective line
    b. 04/05 January 2012: Convective line
4. Summary

PV: Potential Vorticity

- PV is the product of
  - Absolute vorticity (relative + planetary) and
  - Stability
- High PV
  - near troughs and near the polar tropopause
  - Stratosphere (due to high stability)

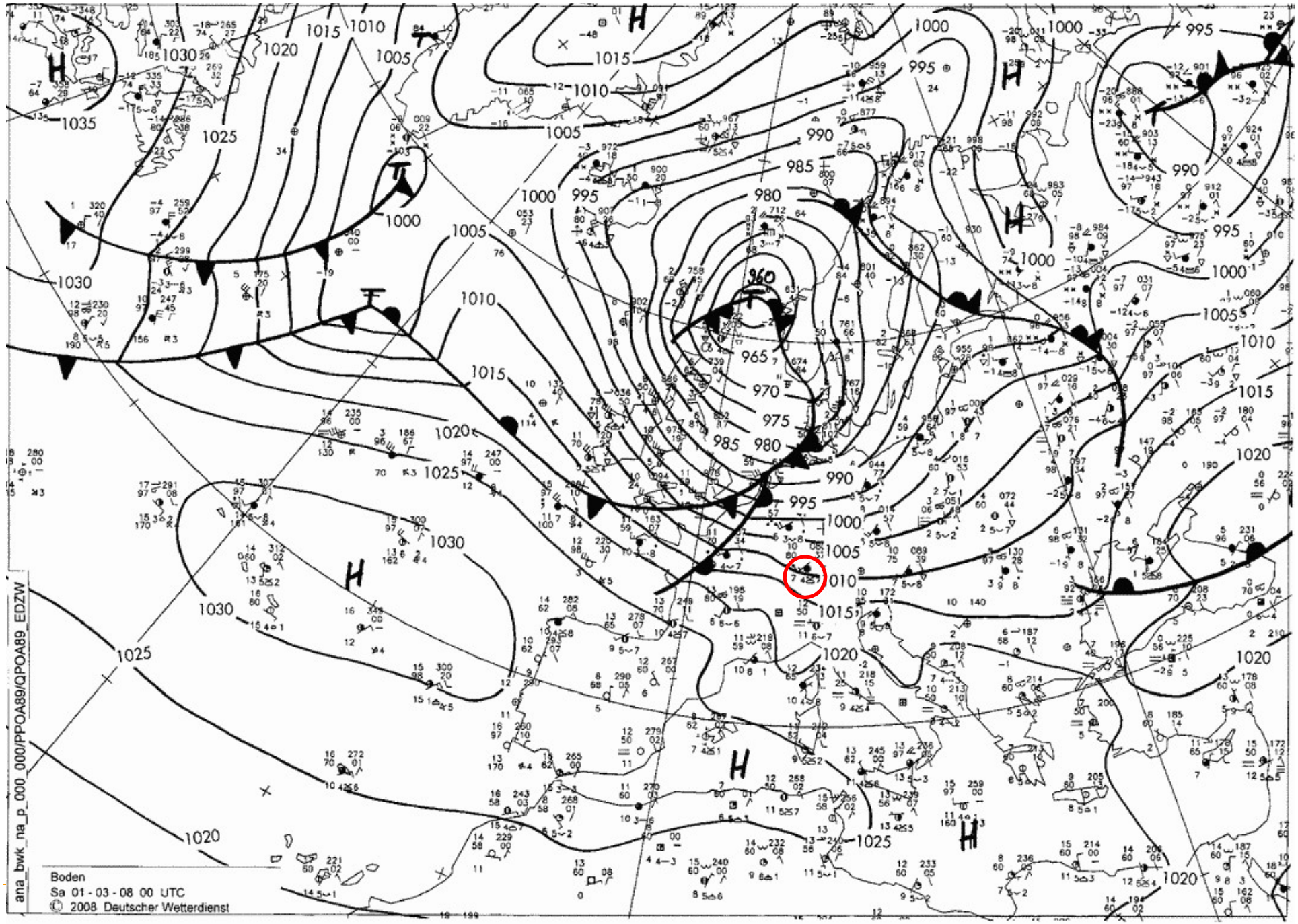
- More in my presentation from 12-12-2022 (Basics of Water vapour channels in satellite products) from 09:00 – 09:30 UTC

Additional information

https://resources.eumetrain.org/satmanu/Basic/Parameters/navmenu.php?page=5.0.0

Enlarging the images: „Click in the image

Close the images: Click „cross", top right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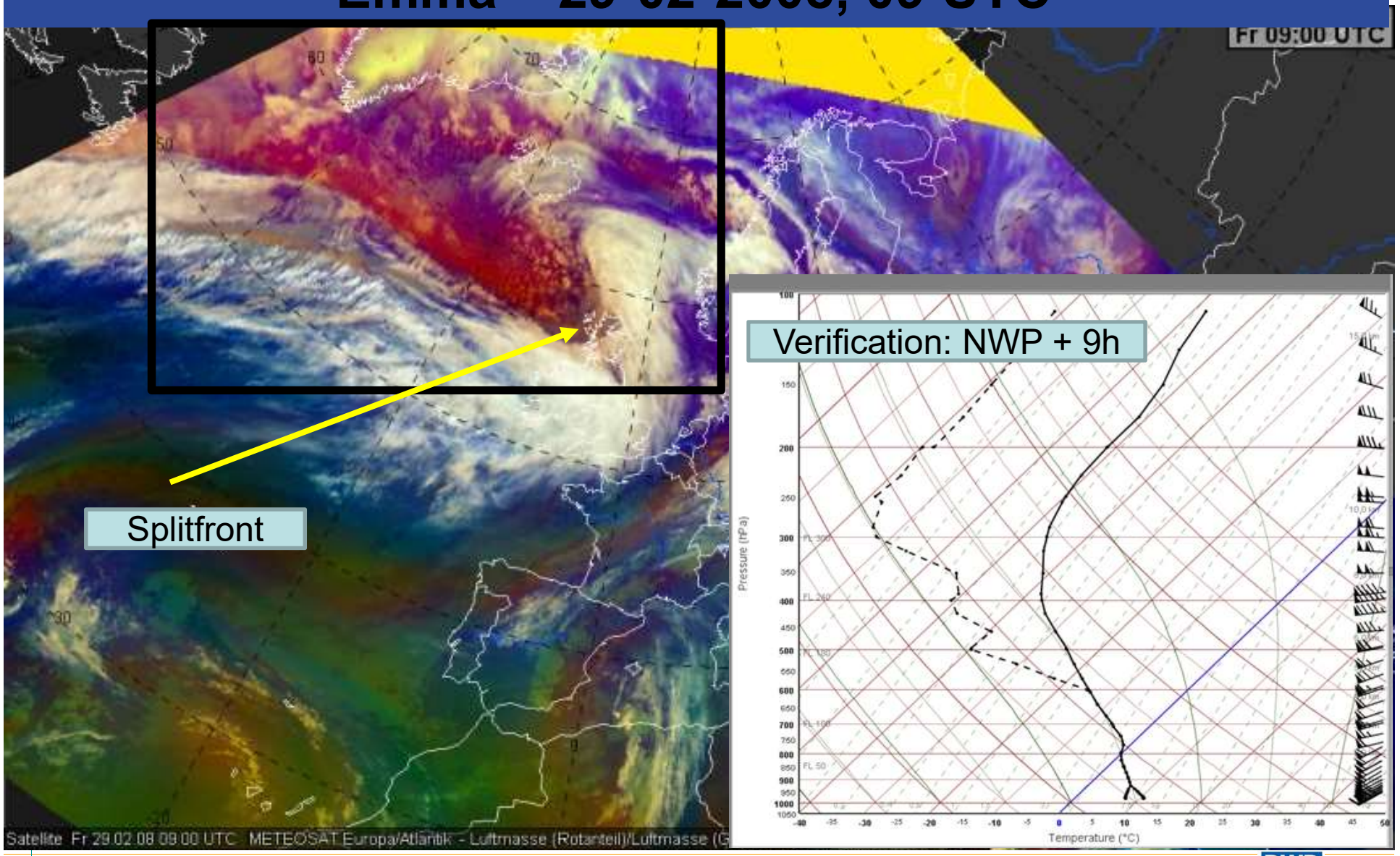
Emma – 29-02-2008, 09 UTC



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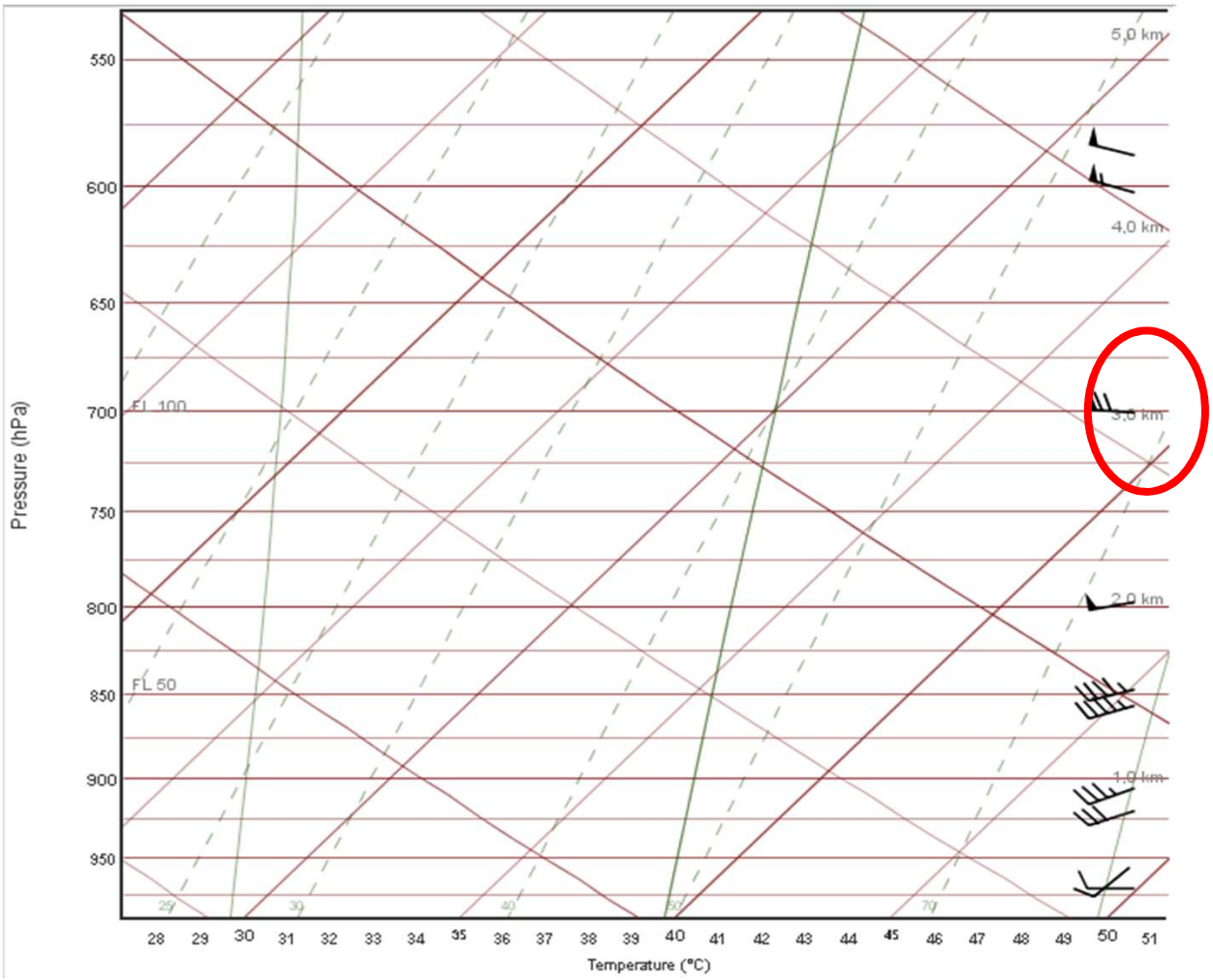
Radiosounding from Stuttgart (01-03-2008, 00 UTC)



First indication already 9 hours before the cold front‘s passage

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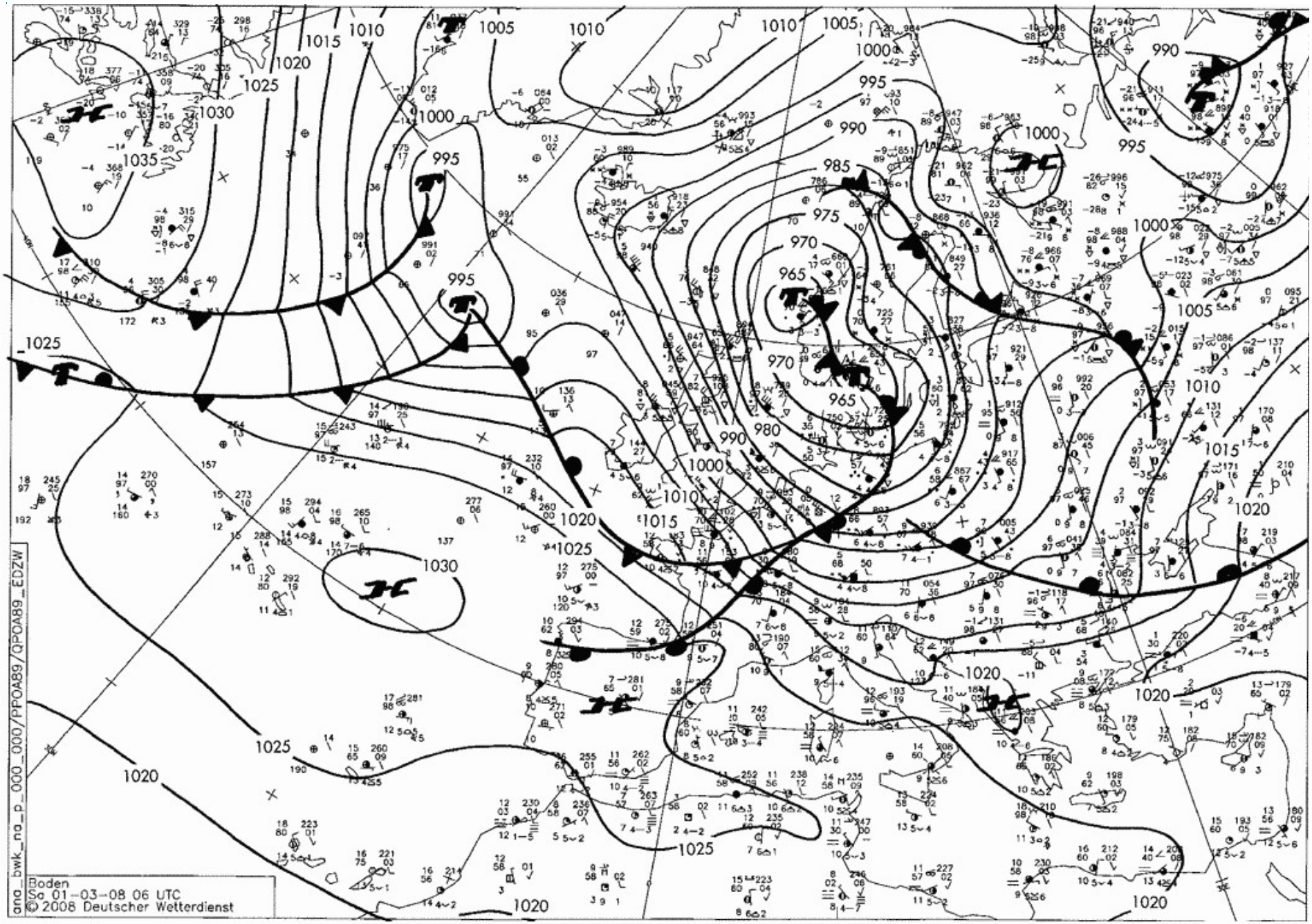
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Sa 01-03-08 06 UTC
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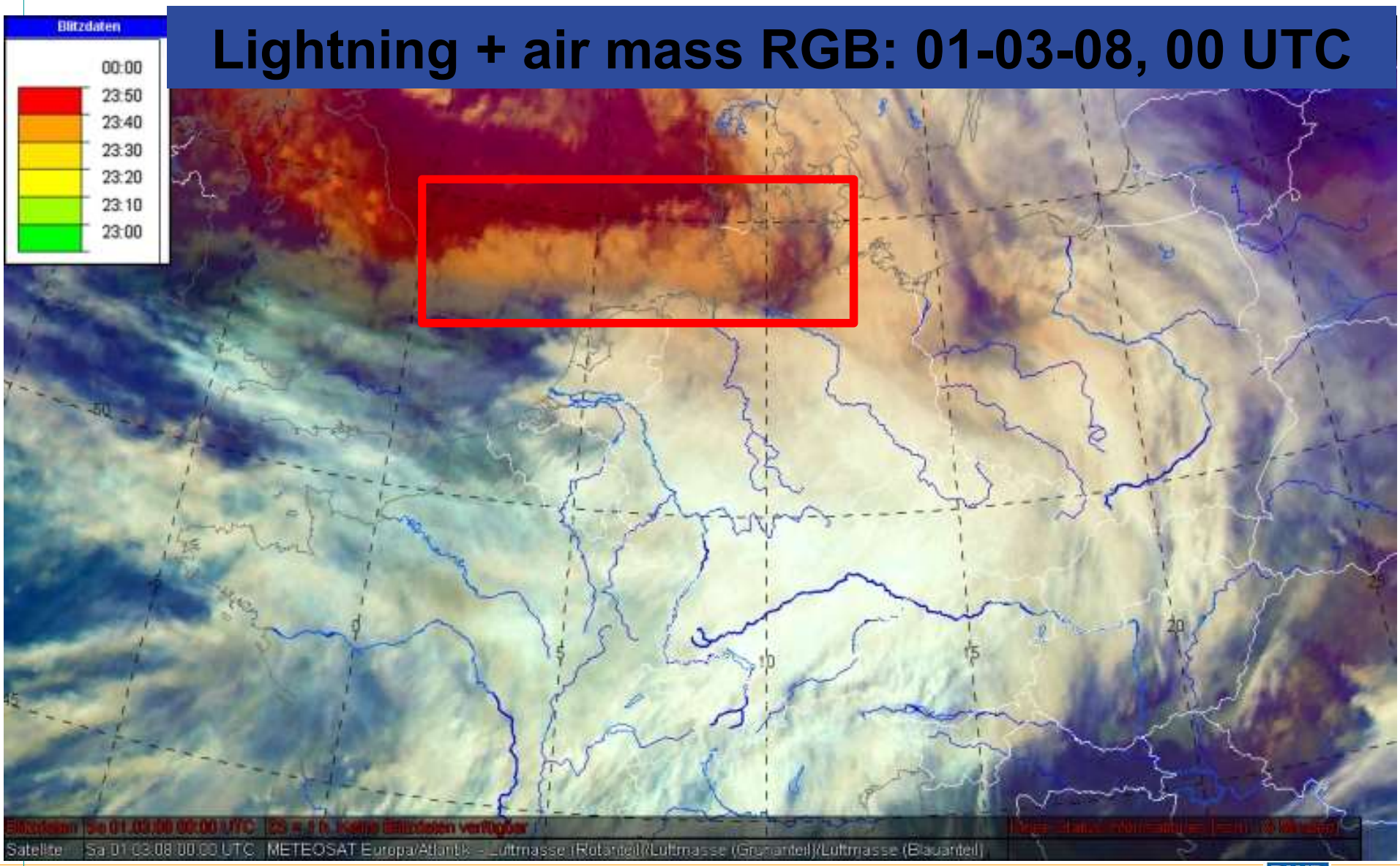
Lightning + air mass RGB: 01-03-08, 00 UTC



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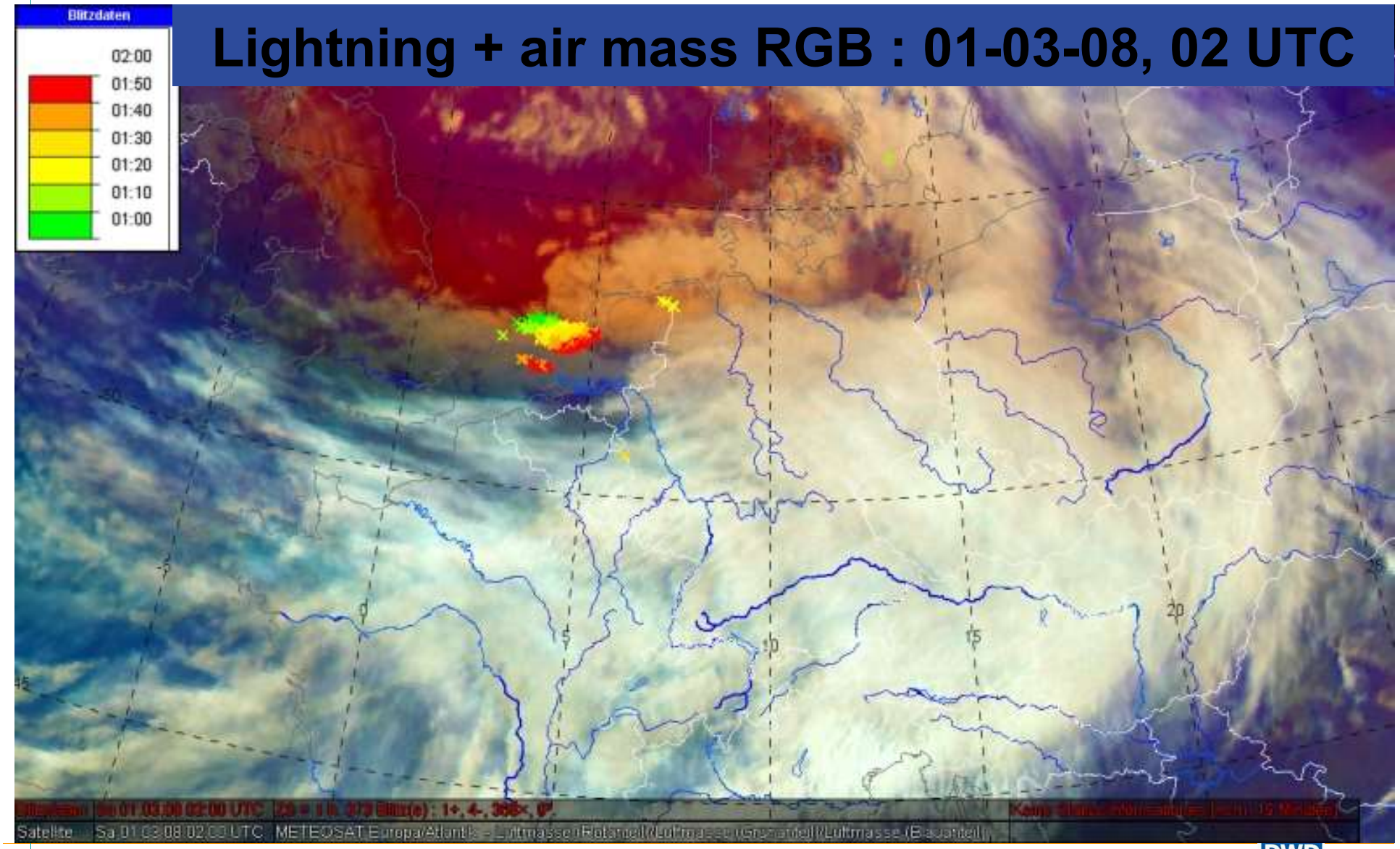
Lightning + air mass RGB : 01-03-08, 02 UTC



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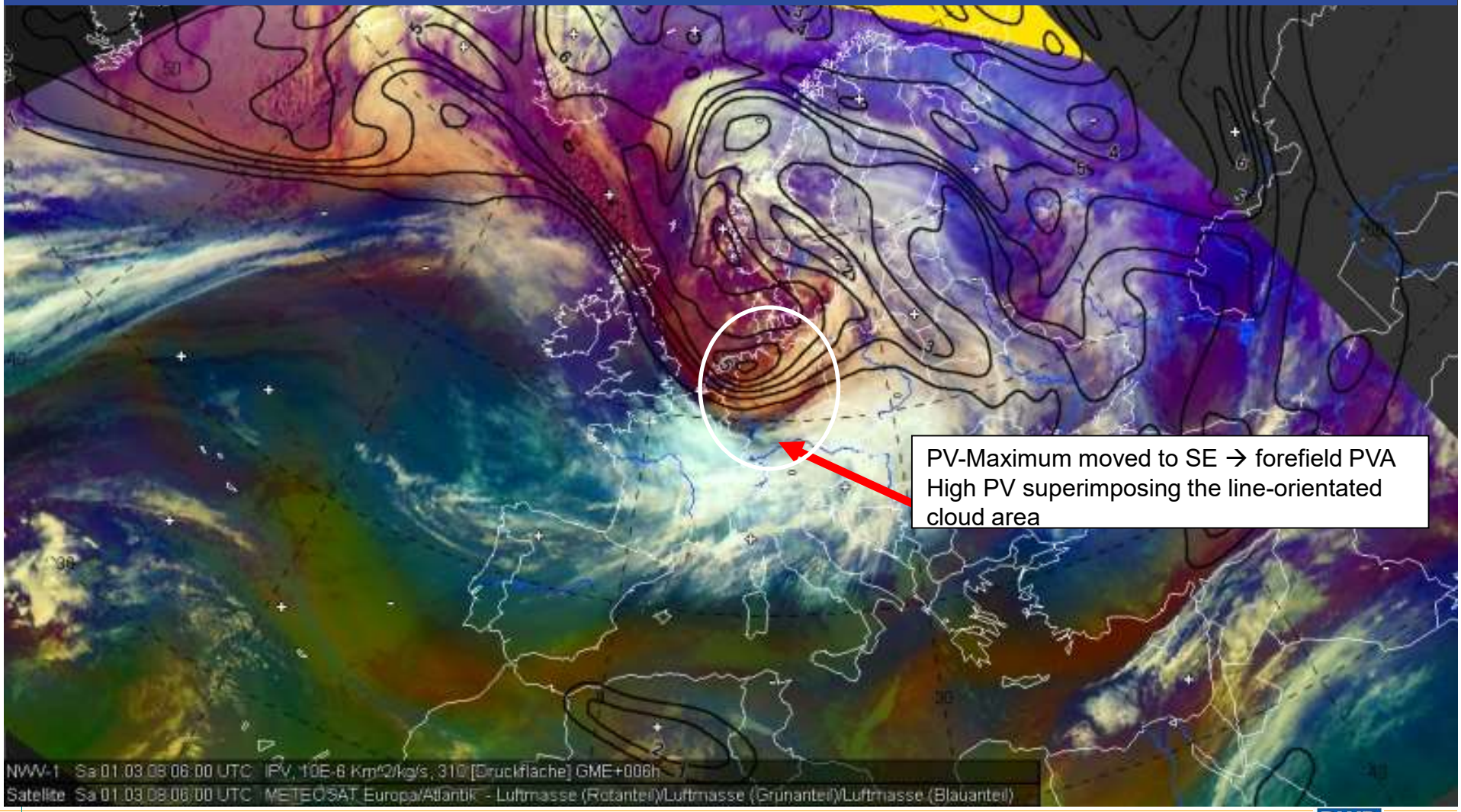
Air mass RGB: IPV in 310 K (01-03-2008, 06 UTC)



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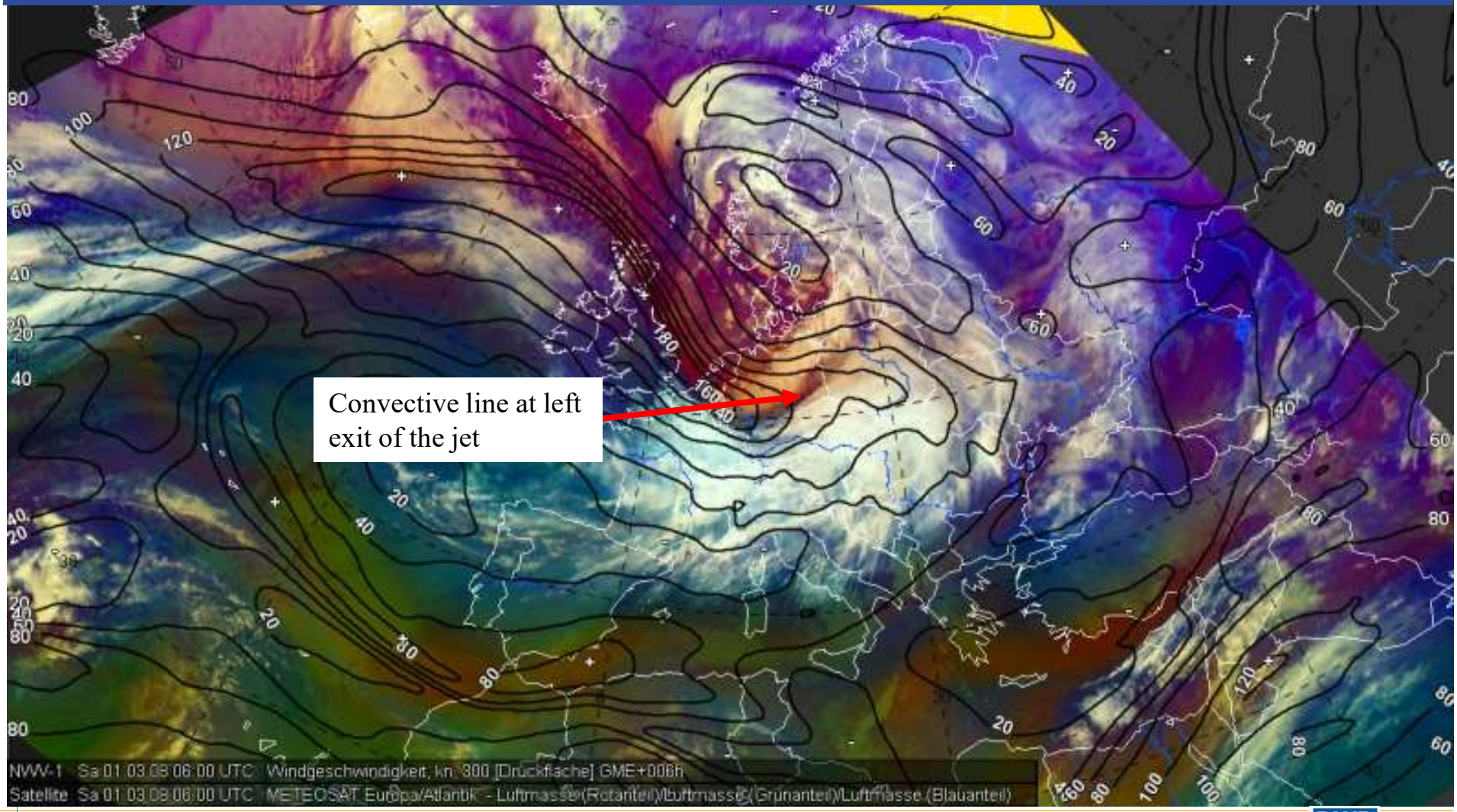
Air mass RGB, ff300: 01-03-2008, 06 UTC



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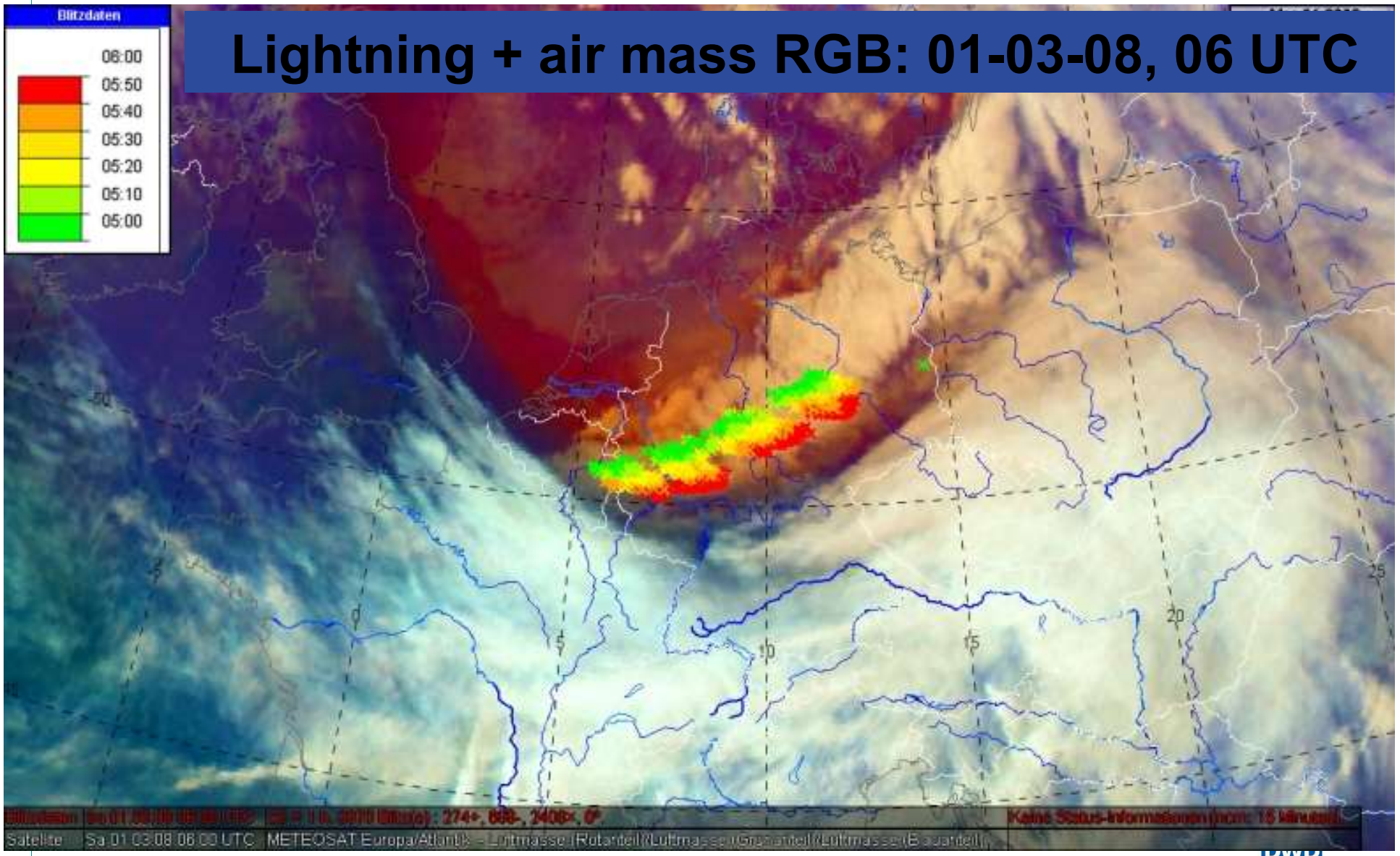
DWD

Lightning + air mass RGB: 01-03-08, 06 UTC



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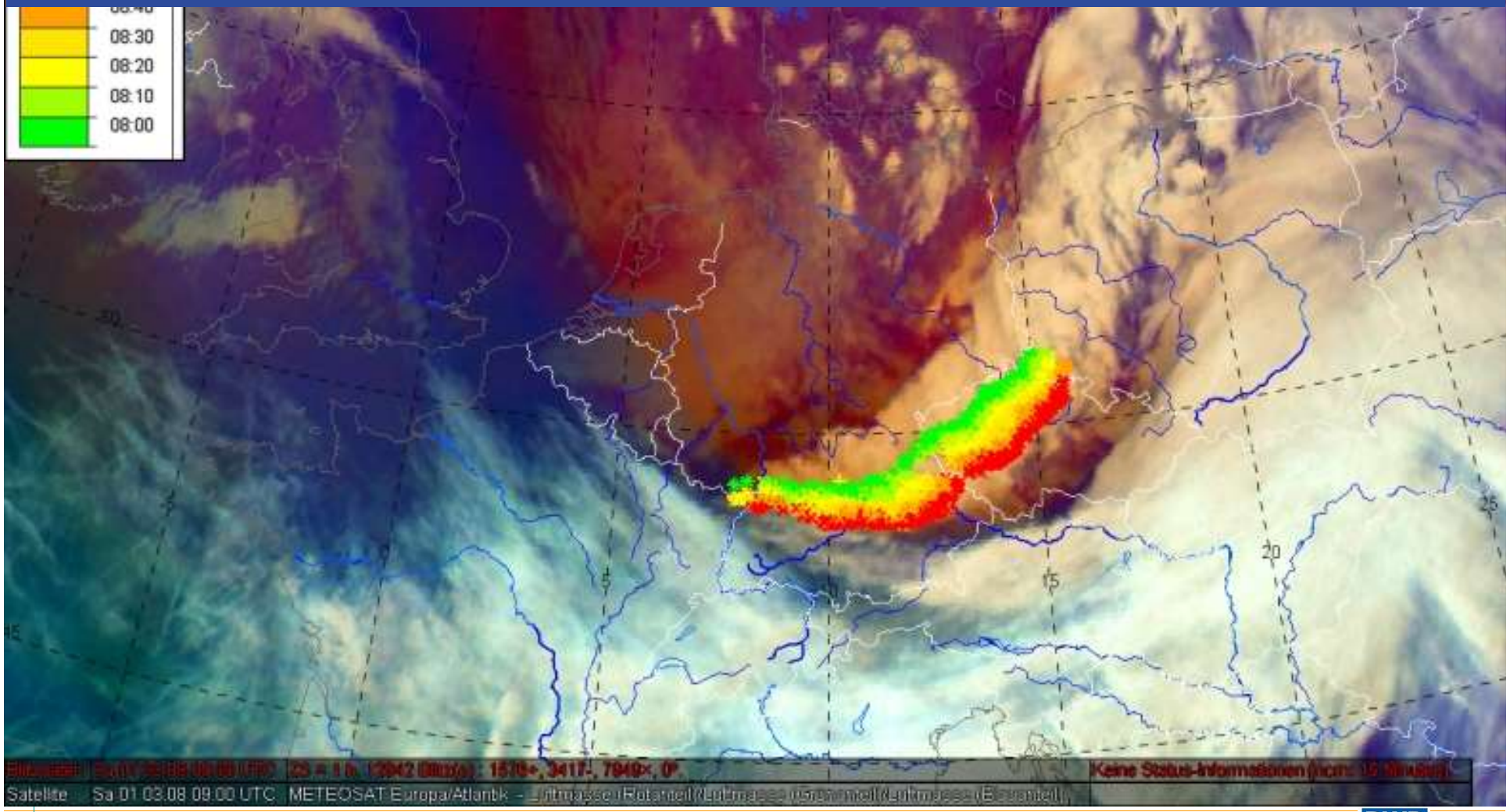
Lightning + air mass RGB 01-03-08, 09 UTC: about 12,000 lightnings during the last hour, 120 to 140 km/h!



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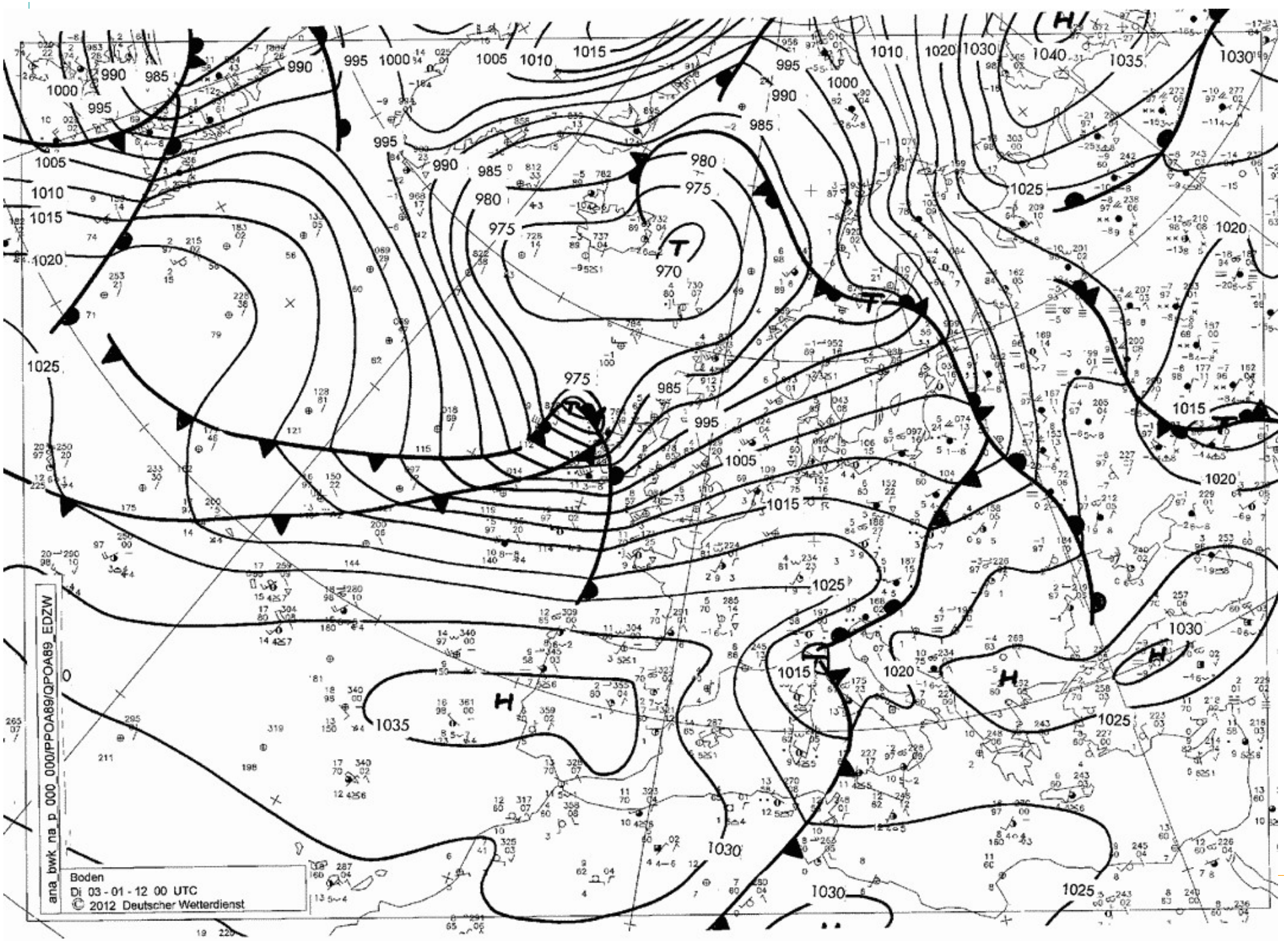
Additional material

- **Very detailed and long: Emma-storm (29-02/01-03-2008)**
  - https://resources.eumetrain.org/data/4/4/intro.htm

Example (03.01.2012)

No convective line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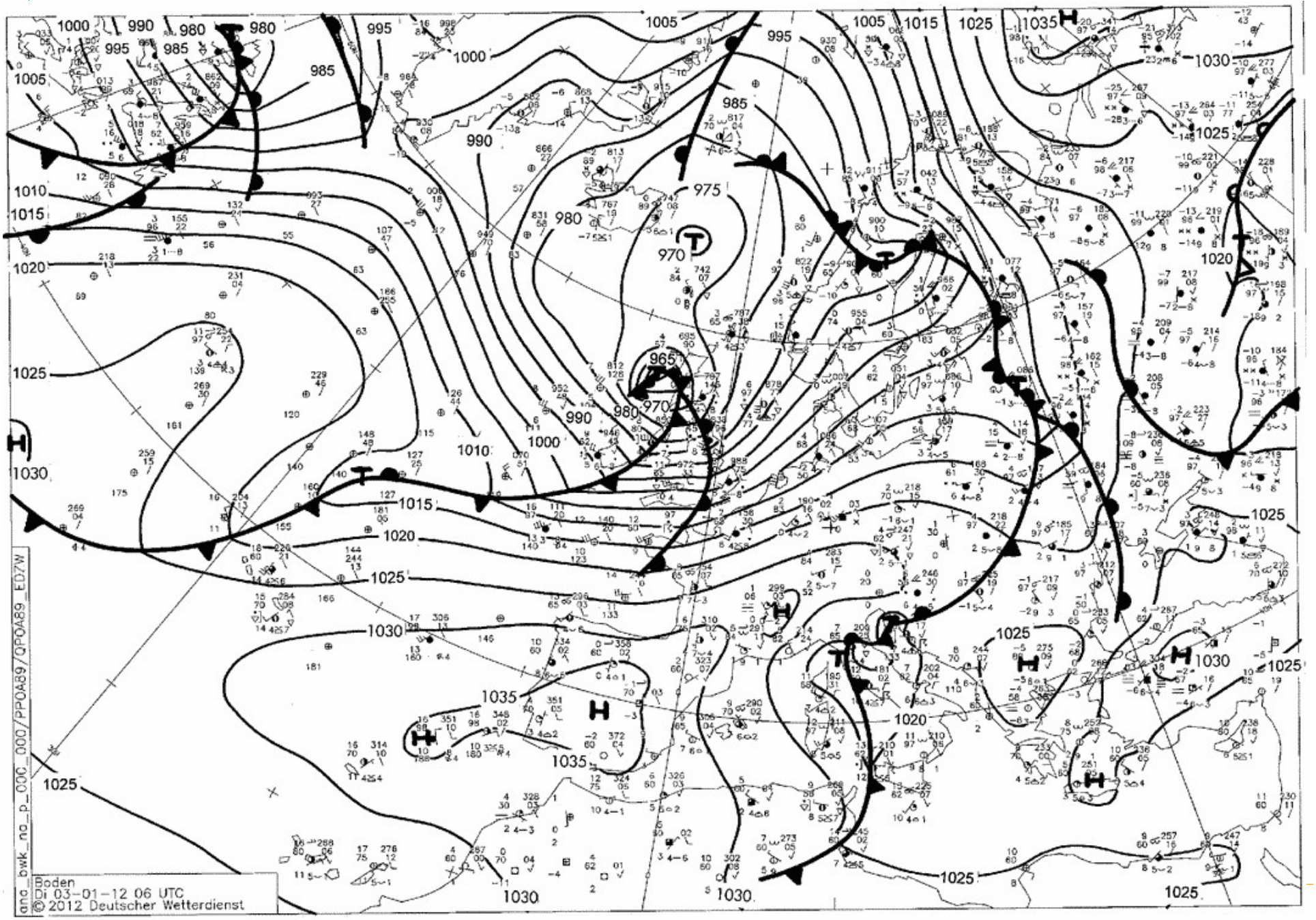
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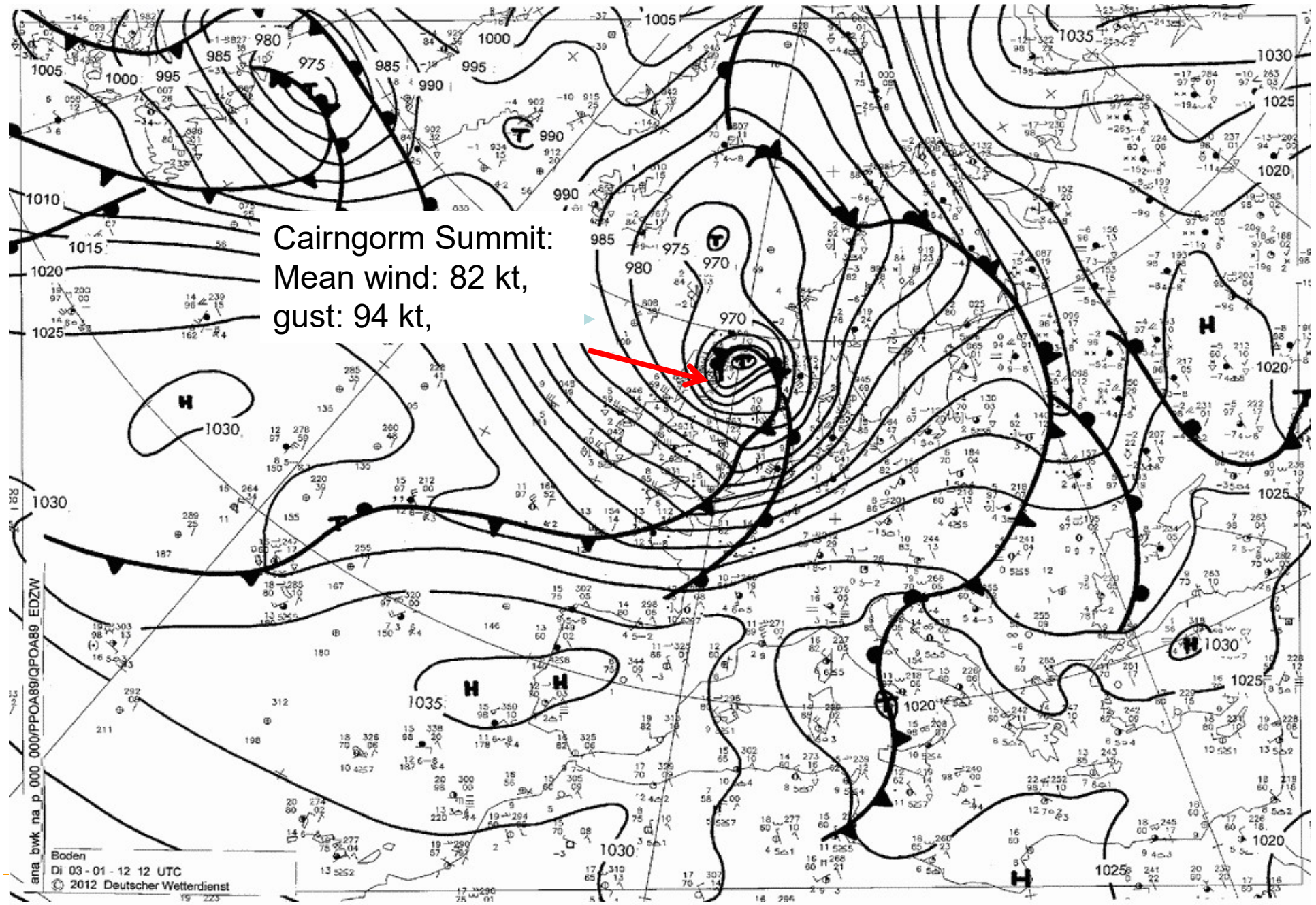
Cairngorm Summit:
Mean wind: 82 kt,
gust: 94 kt,
Boden
Di 03 - 01 - 12 12 UTC
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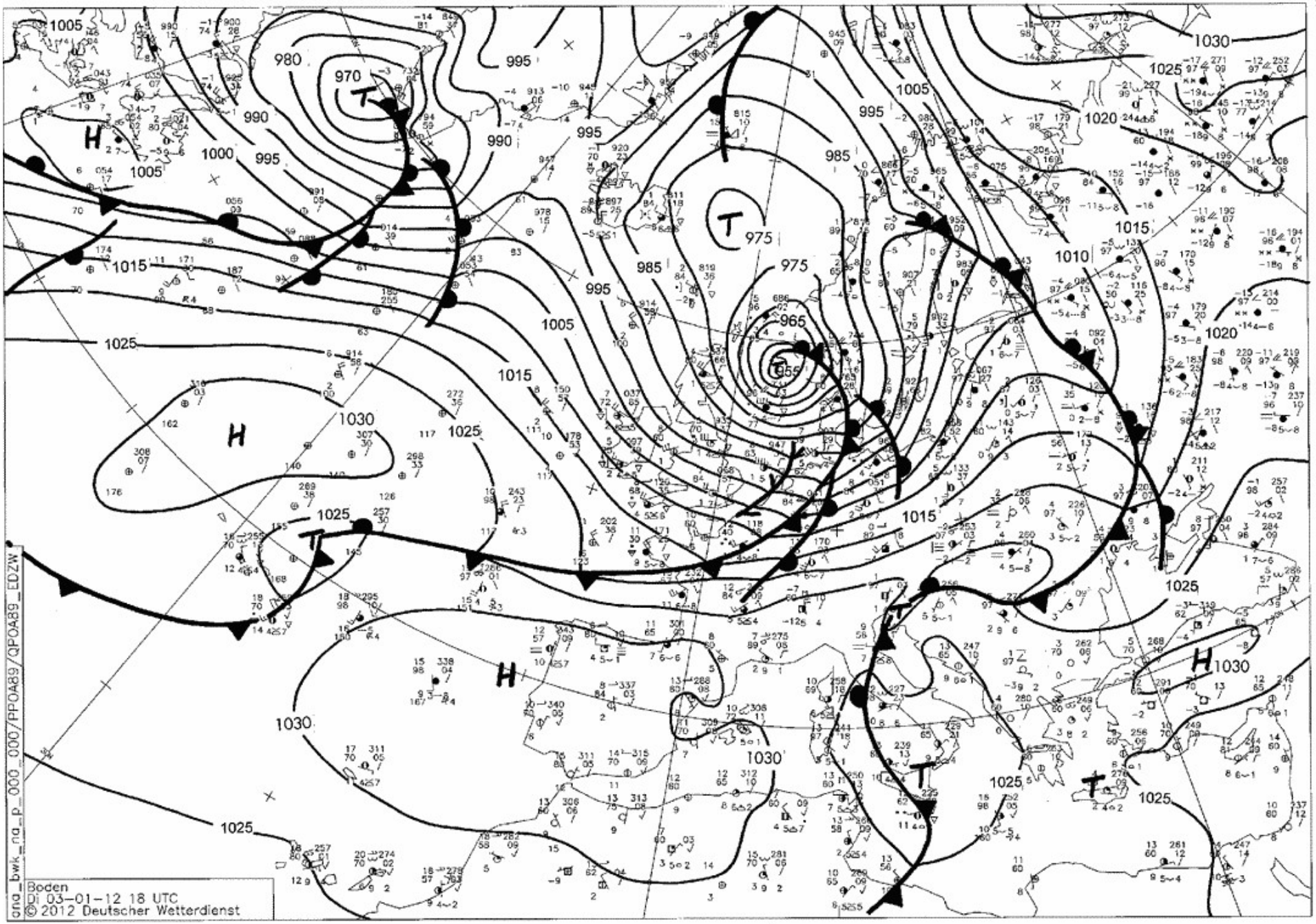
ana_bwk_na_p_000_000/PPOA89/QPOA89_EDZW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Di 03-01-12 18 UTC
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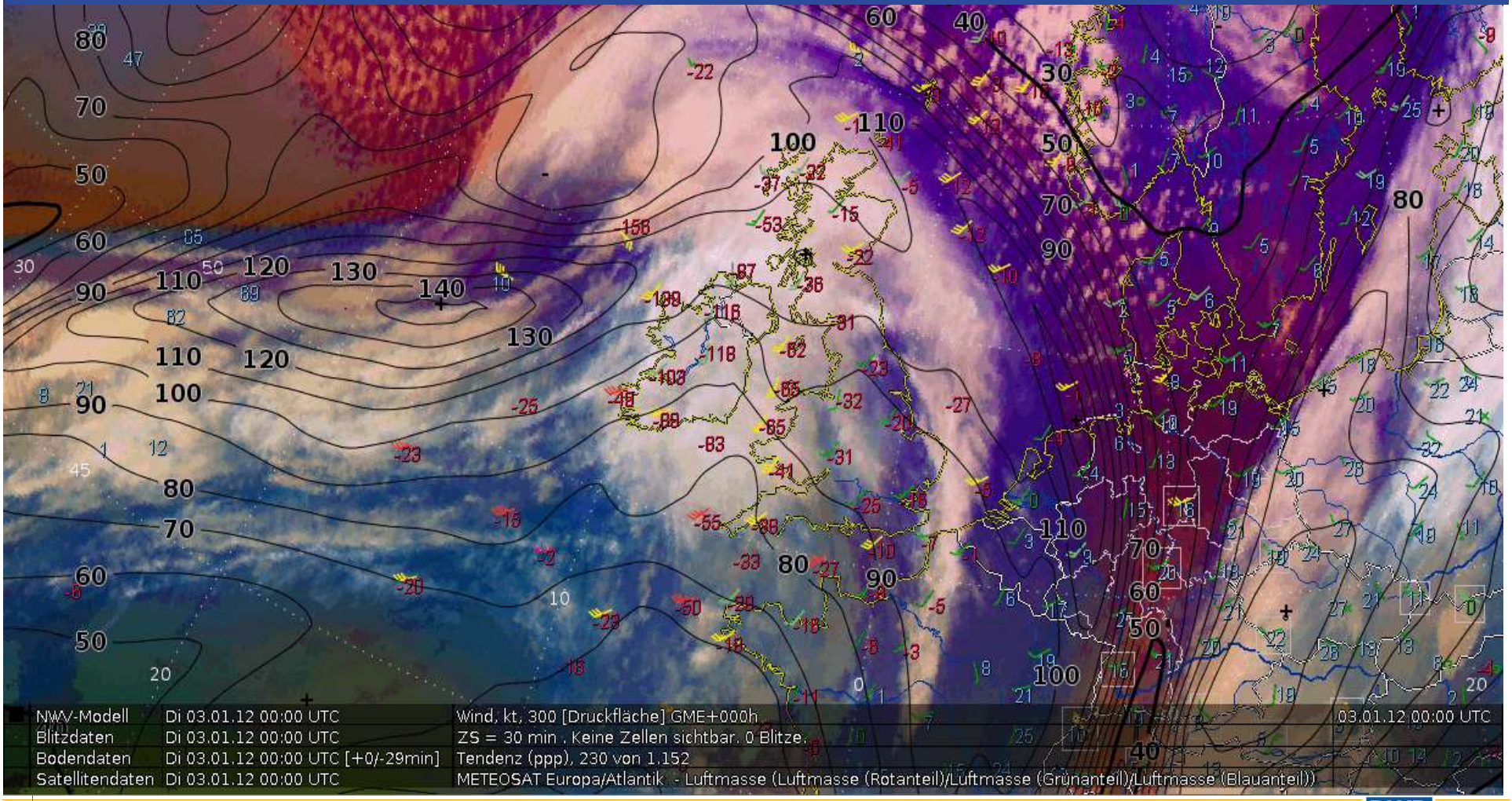
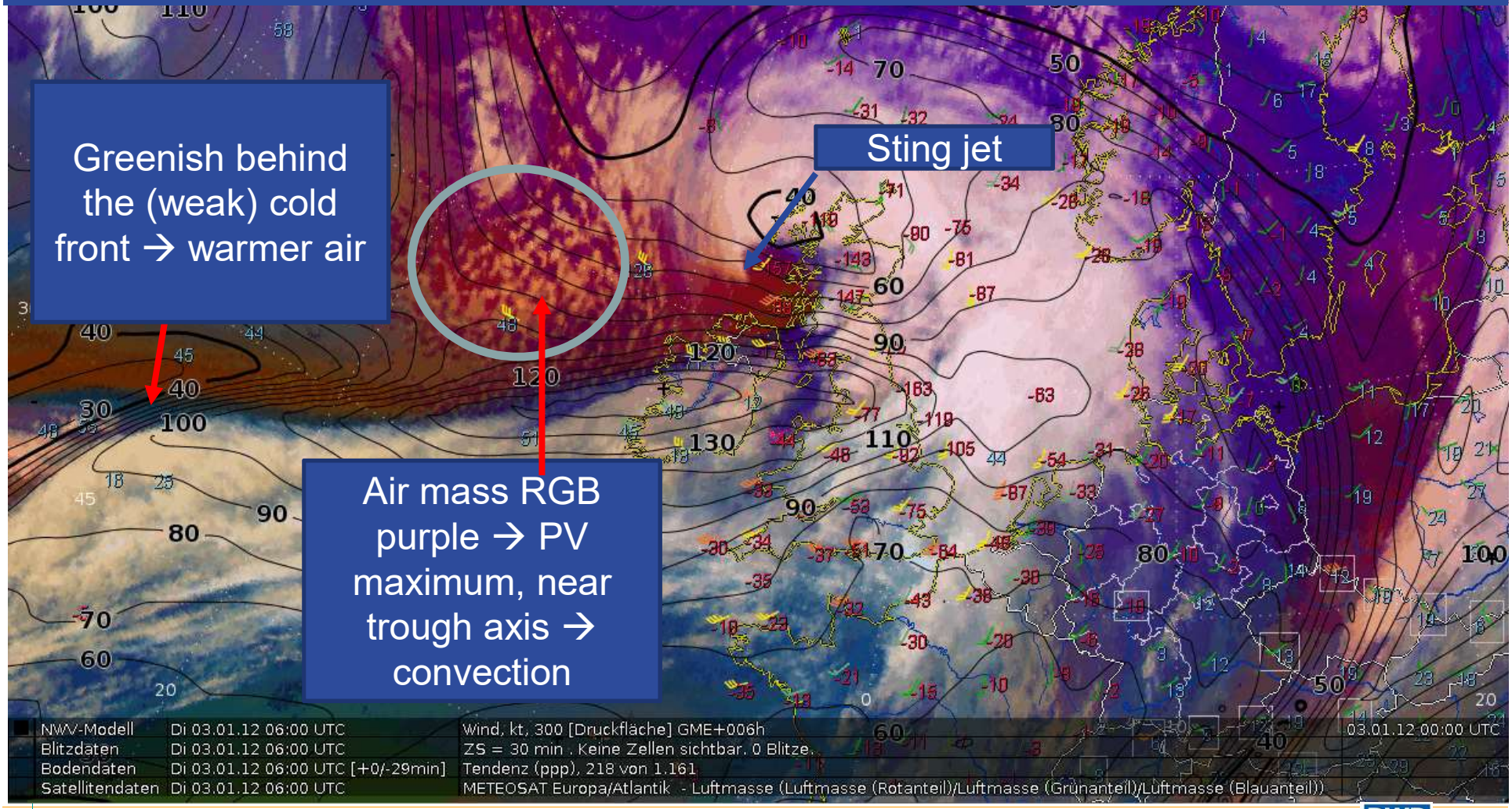
Air mass RGB + ff300 hPa [kt] + appp/3h [hpa/10] + ff10m [wind barb] 03-01-2012, 00 UTC



EUMETRAIN

DWD

Air mass RGB + ff300 hPa [kt] + appp/3h [hpa/10] + ff10m [wind barb] 03-01-2012, 06 UTC



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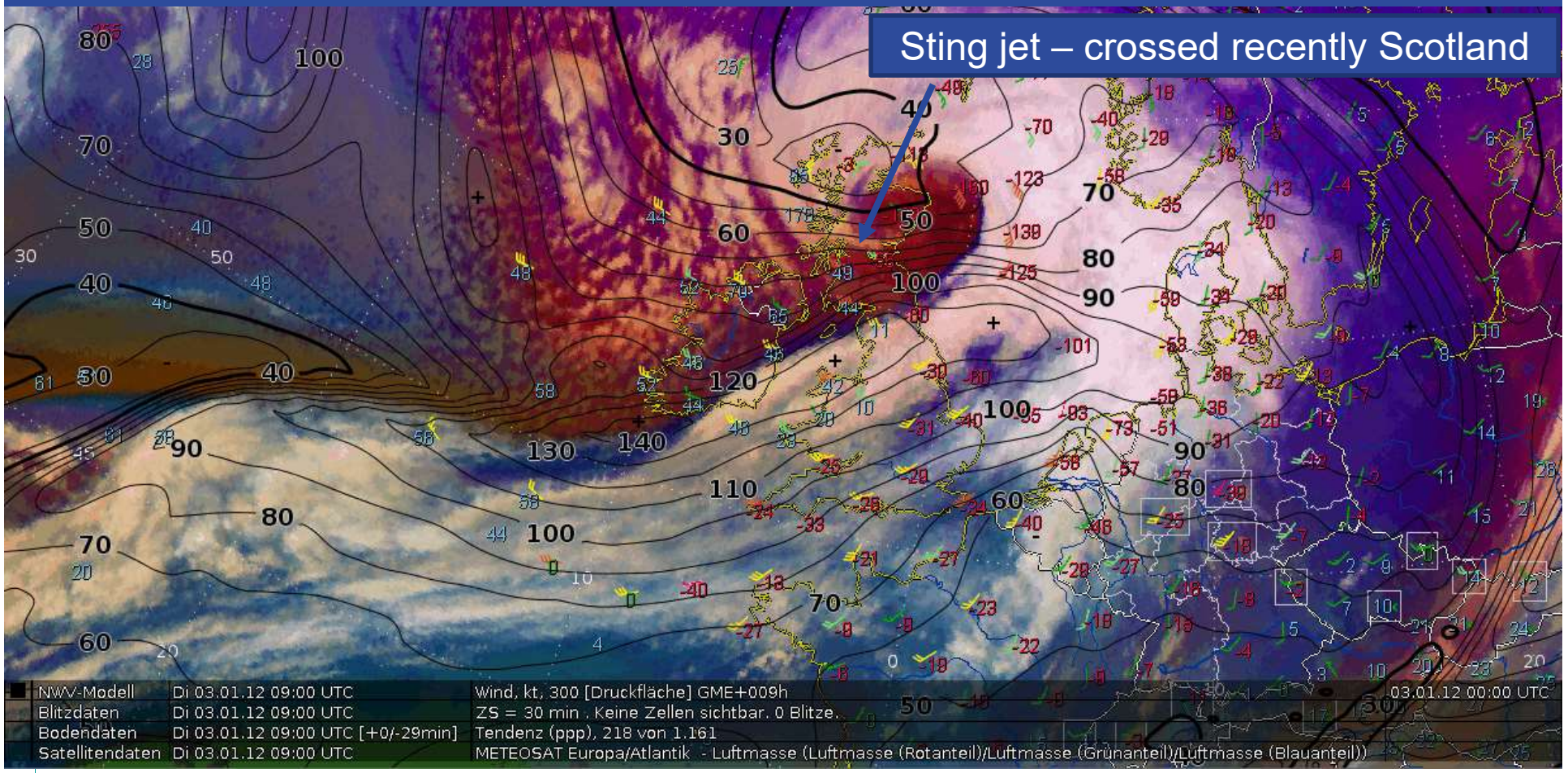
Air mass RGB + ff300 hPa [kt] + appp/3h [hpa/10] + ff10m [wind barb] 03-01-2012, 09 UTC



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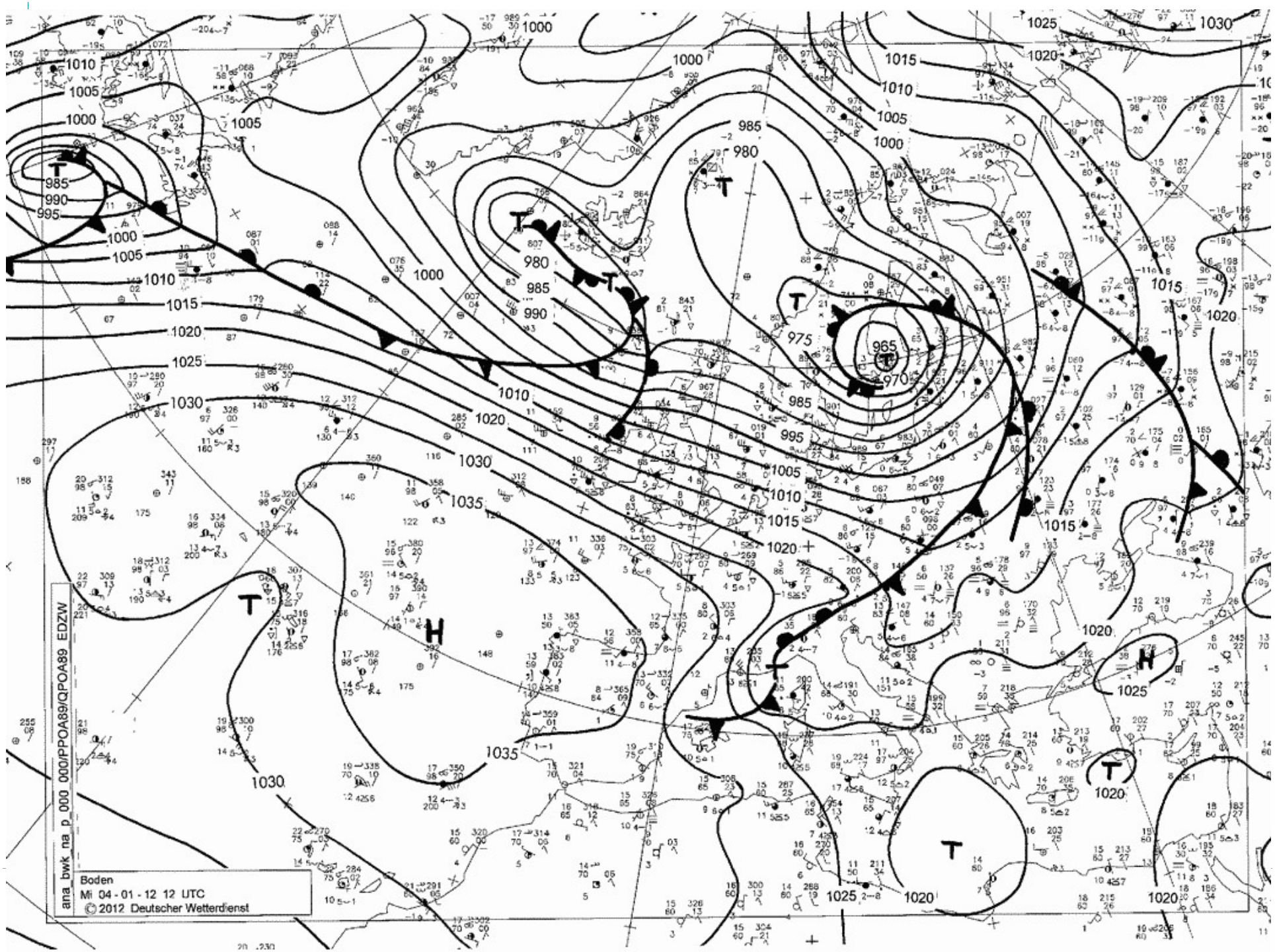
Example (04./05.01.2012)

Convective line developed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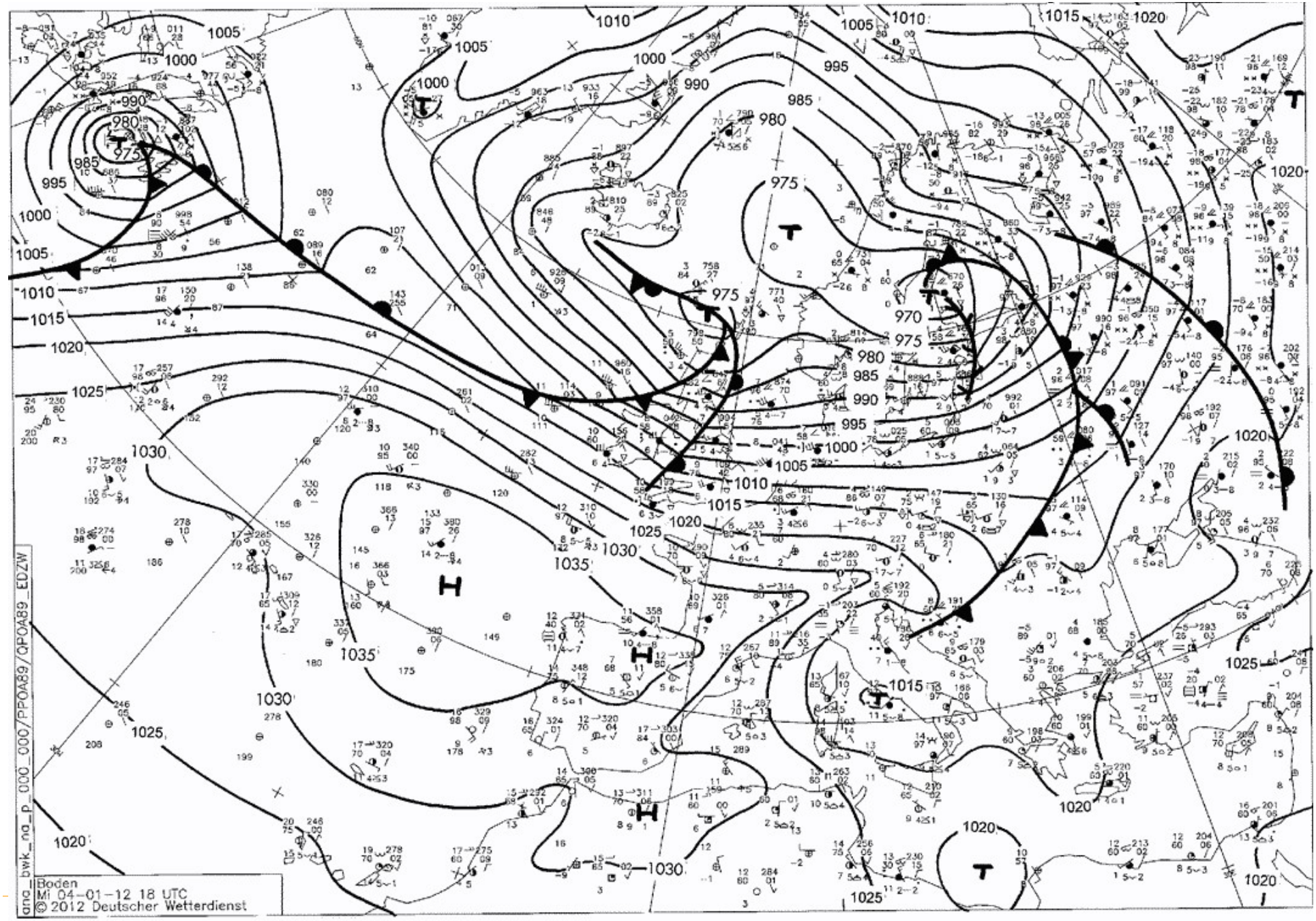
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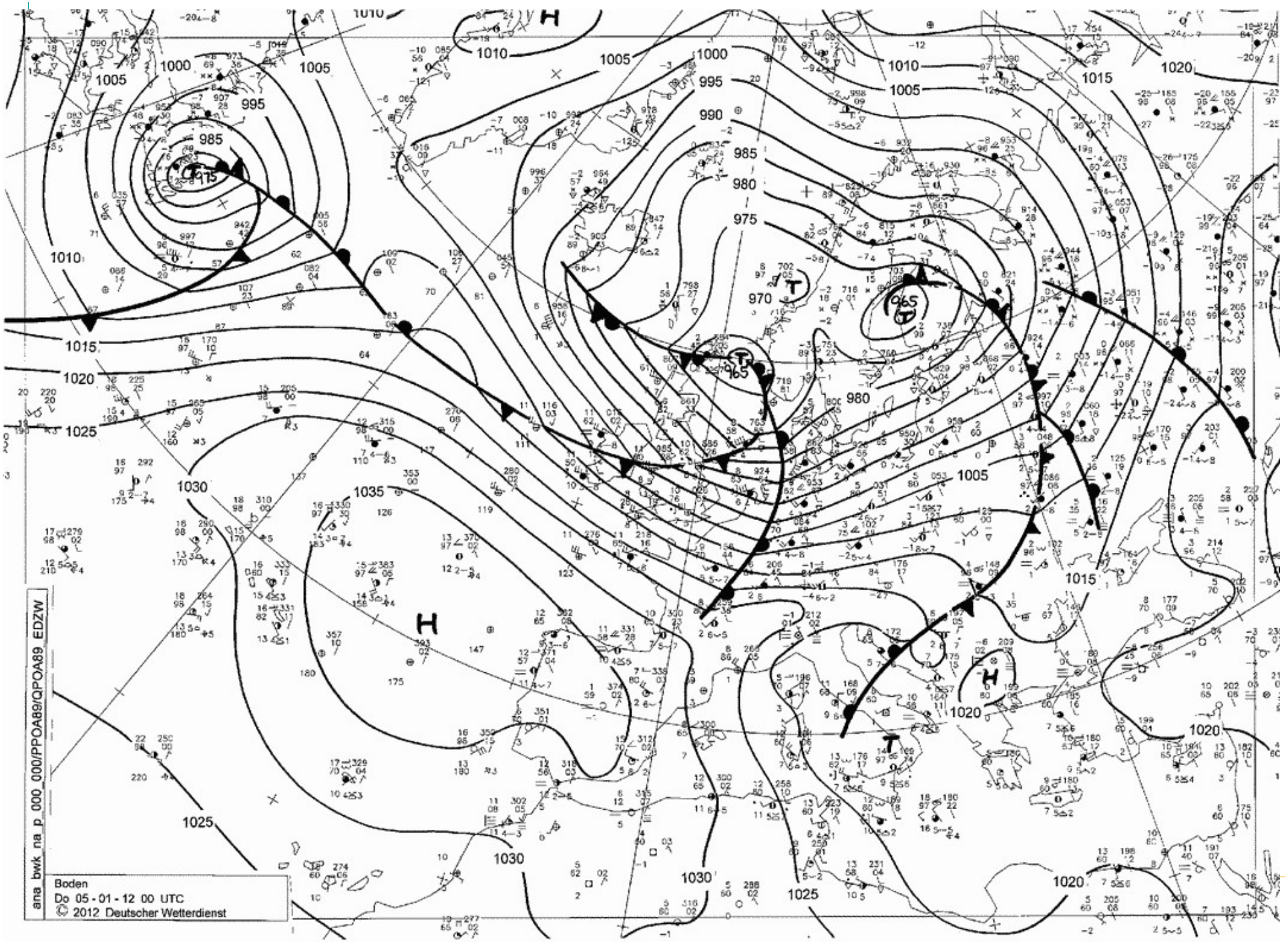
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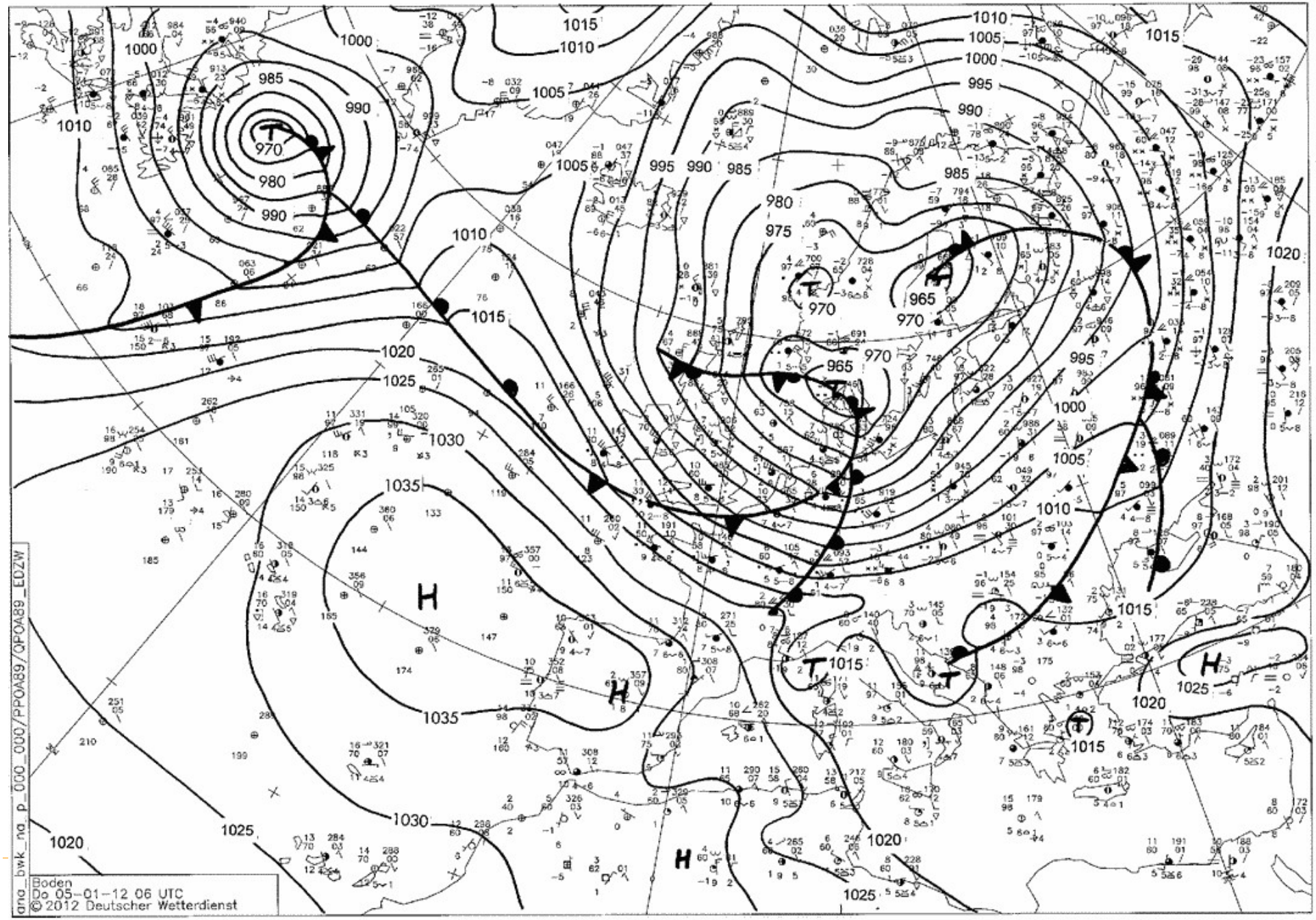
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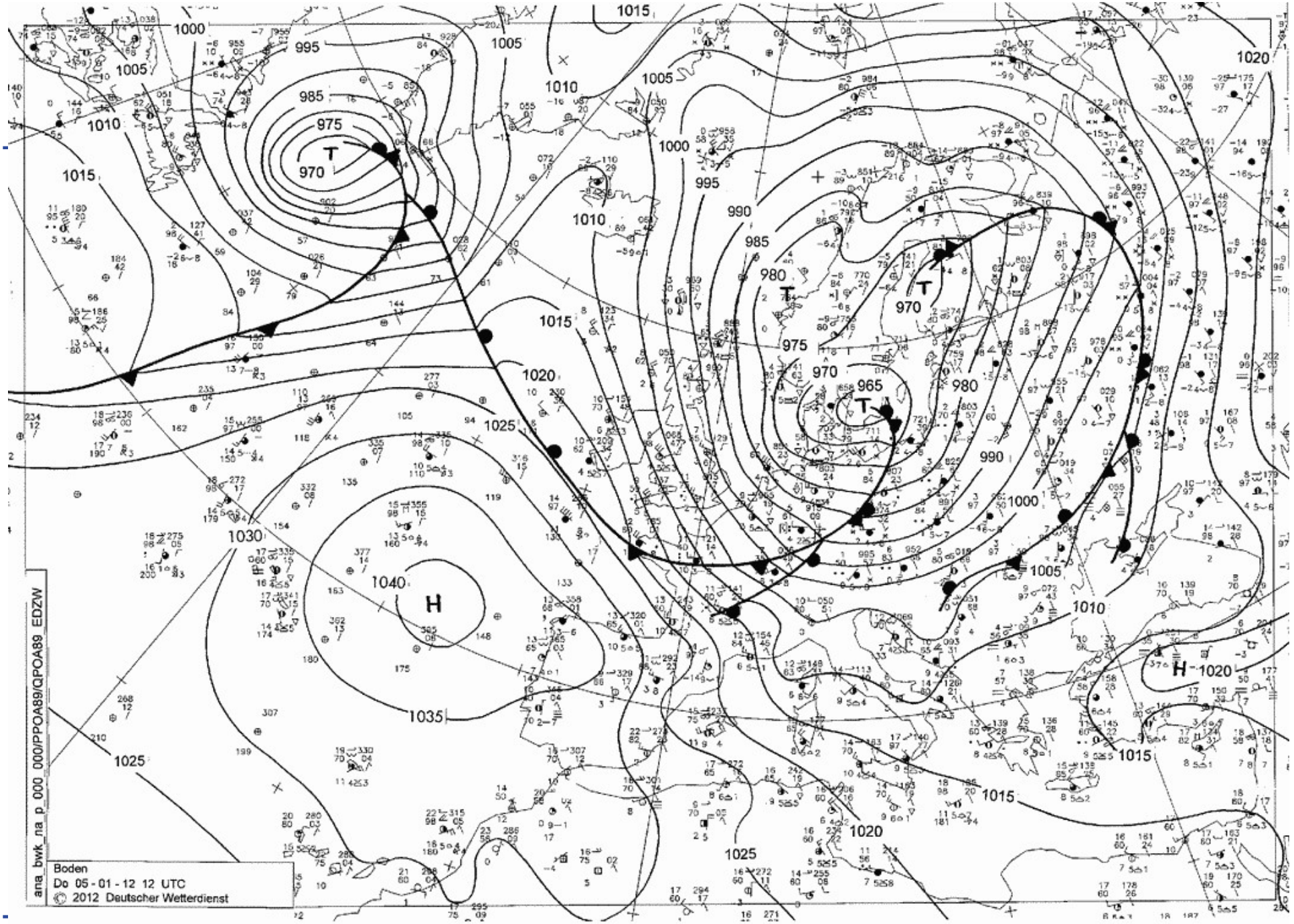
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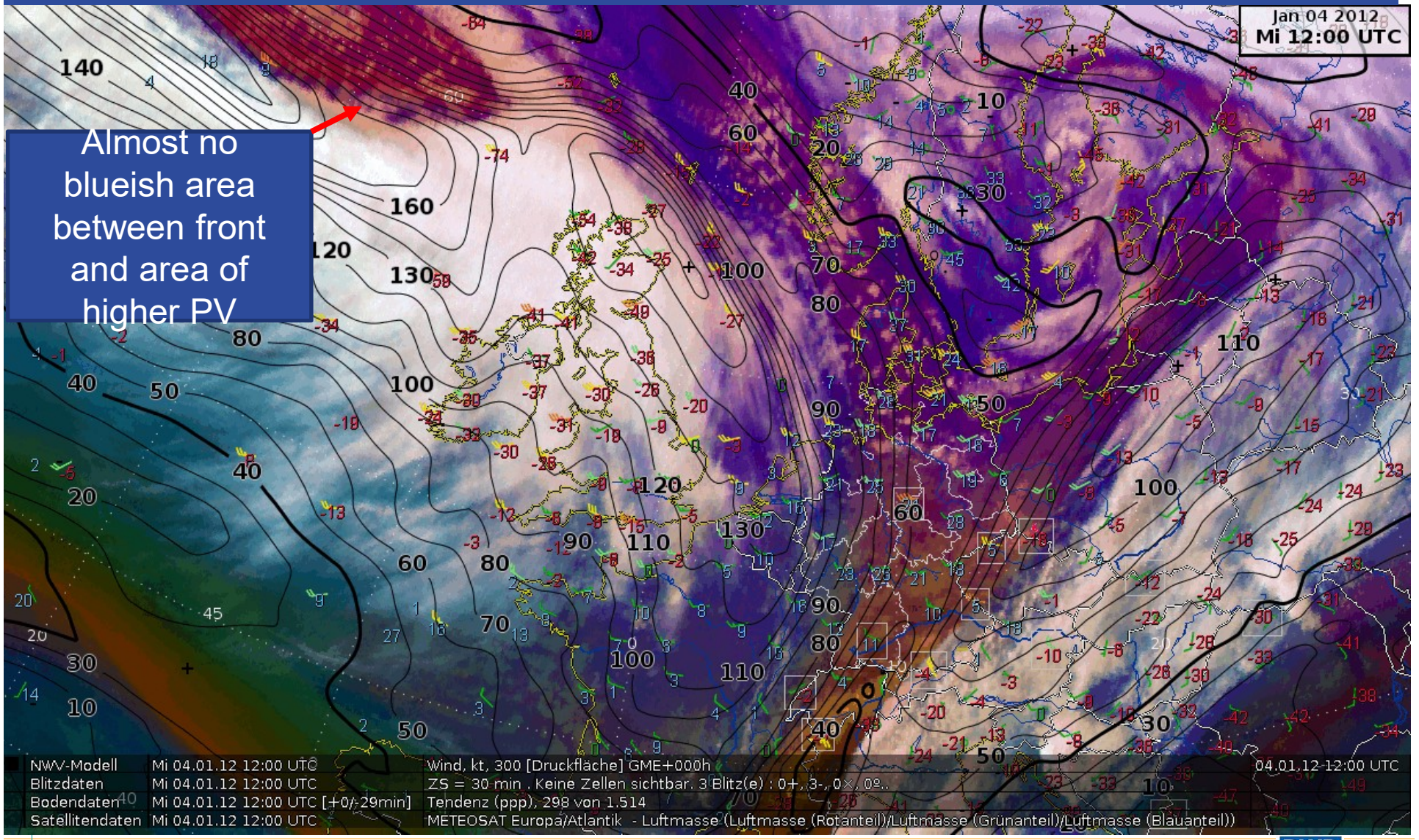
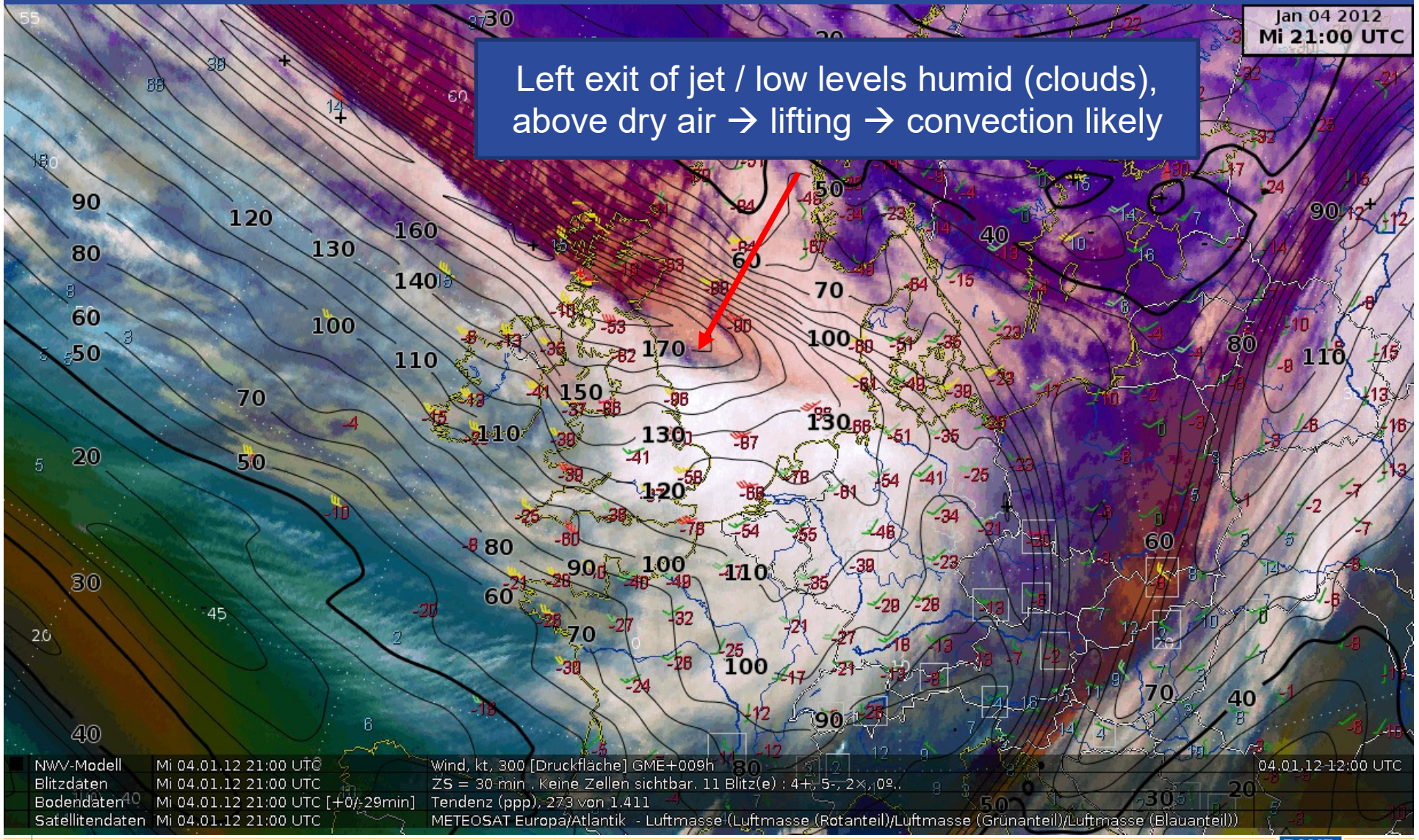
Air mass RGB + ff300 hPa [kt] + appp/3h [hpa/10] + ff10m [wind barb], lightning - 04-01-2012, 12 UTC



EUMETRAIN

DWD

Air mass RGB + ff300 hPa [kt] + appp/3h [hpa/10] + ff10m [wind barb], lightning - 04-01-2012, 21 UTC



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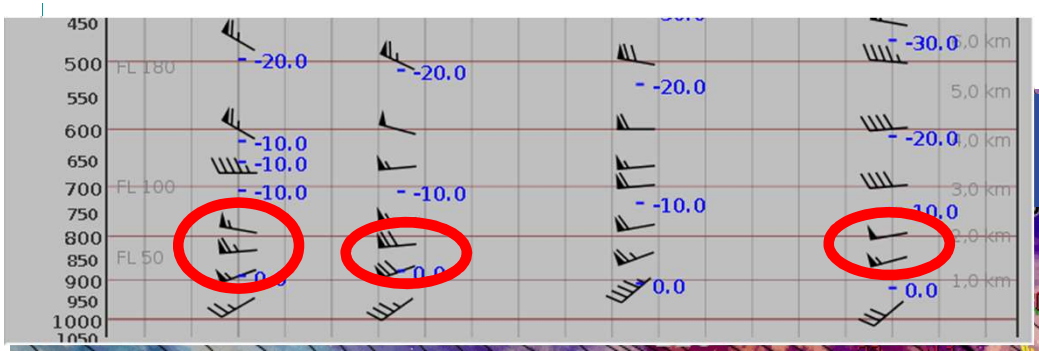
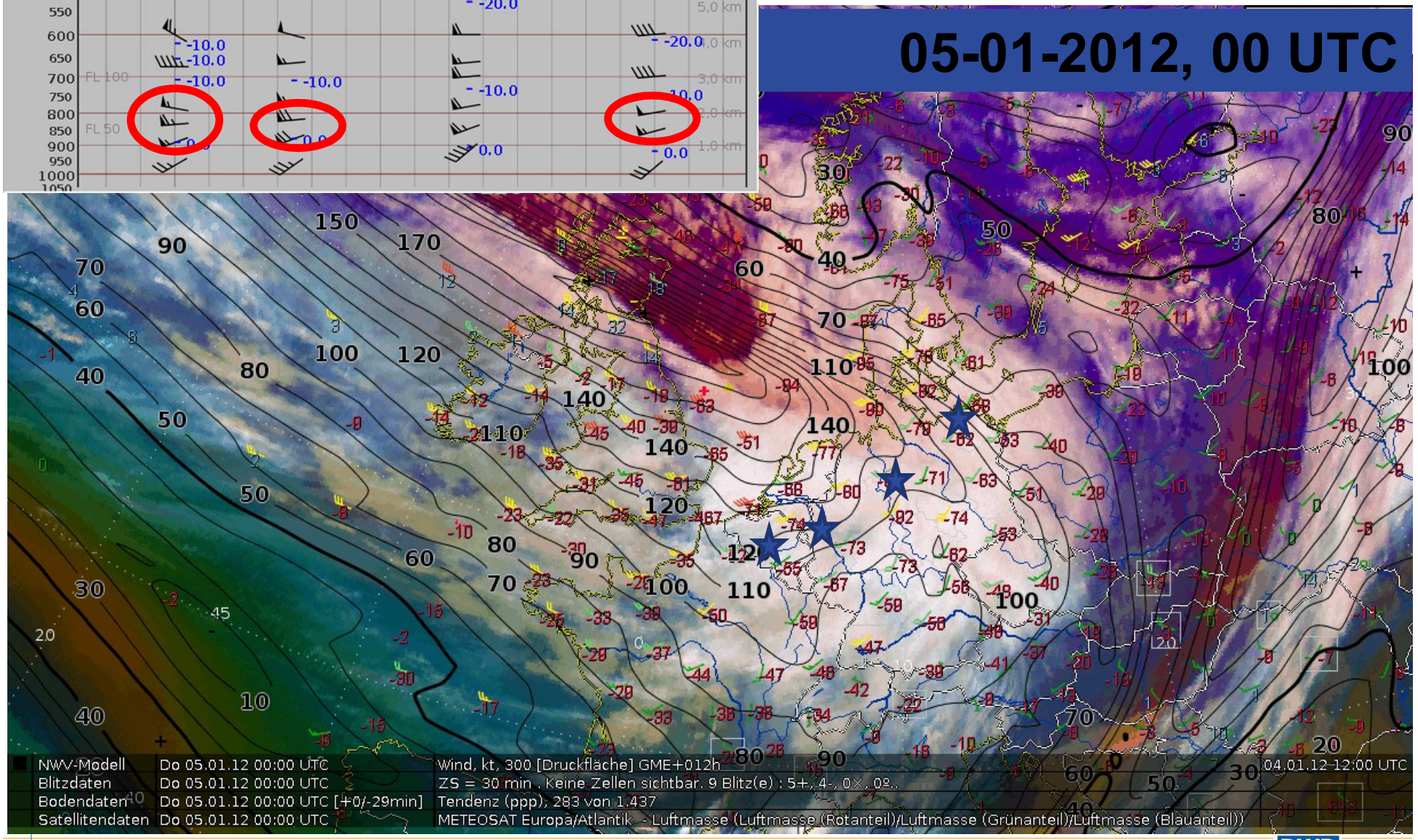
Bruessel Essen Bergen Greifswald (radiosounding measurements)





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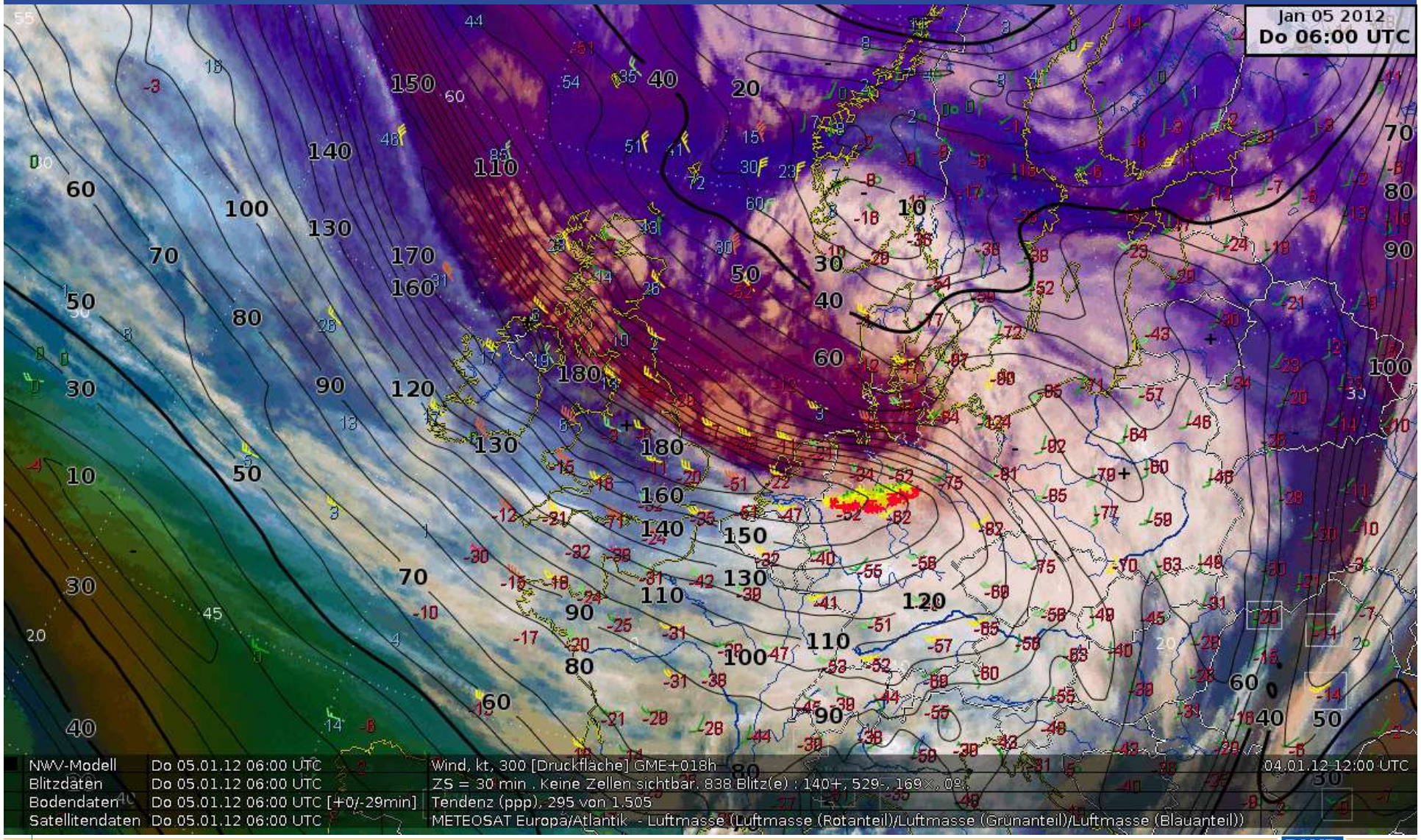
DWD

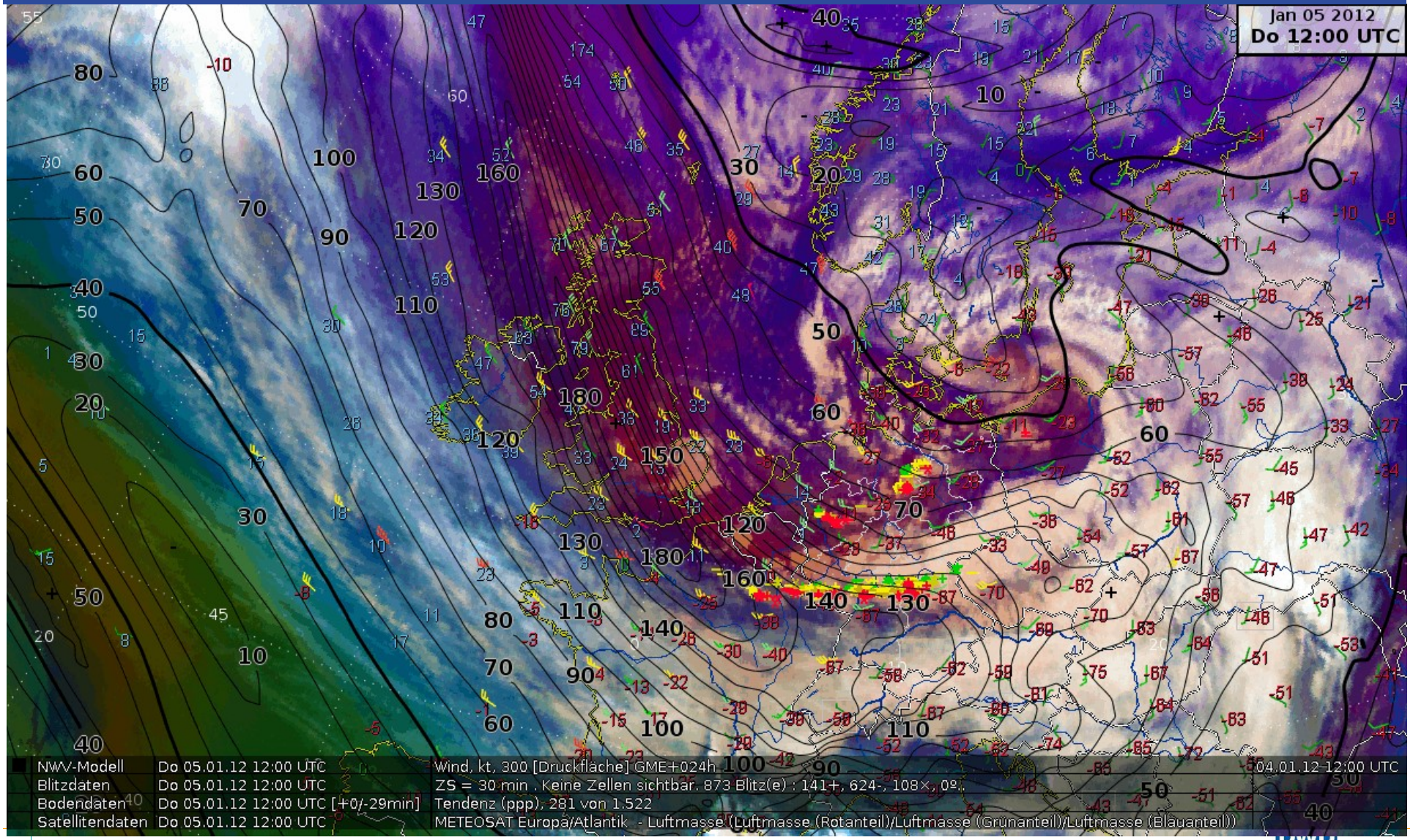
Air mass RGB + ff300 hPa [kt] + appp/3h [hpa/10] + ff10m [wind barb], lightning - 05-01-2012, 06 UTC



EUMETRAIN

DWD

Air mass RGB + ff300 hPa [kt] + appp/3h [hpa/10] + ff10m [wind barb], lightning - 05-01-2012, 12 UTC



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Summary (hints to convective line)

- Potential instability
- Strong convergence of mild and cold air masses
- Strong wind shear „low-level-jet“ in the front‘s forefield
- Cold front propagates with a high angle in relation to the isobars
- Positive Vorticity-Advection ahead of a trough (left exit of a jet)
- Relativ high PV hits (and superimposes) frontal clouds
- First lightning just about to occur if a) near the trough axis, b) within frontal clouds and c) transition from blueish to violet (according to air mass-RGB)