



Foto: Dominik Herka

24 June 2021: violent tornado in
southern Morava



Can a violent tornado occur in these countries?

- A. Italy
- B. Finland
- C. Poland
- D. United Kingdom
- E. Bulgaria



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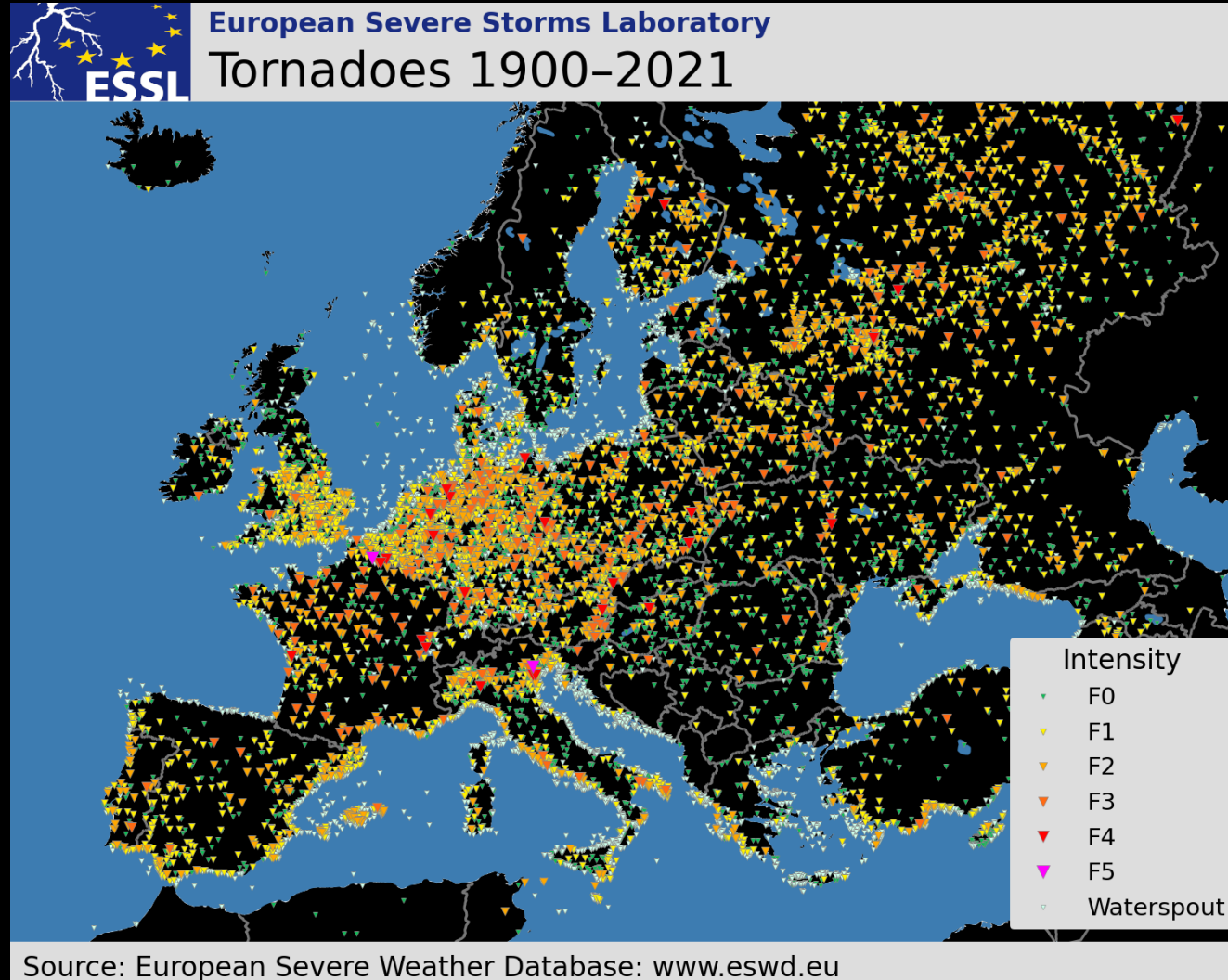
Image 6: F4 damage (strong brick structure, walls partly collapsed) in western Mira close to the Villa Fini, on the other side of the streamer (photo: Alberto Gobbi)



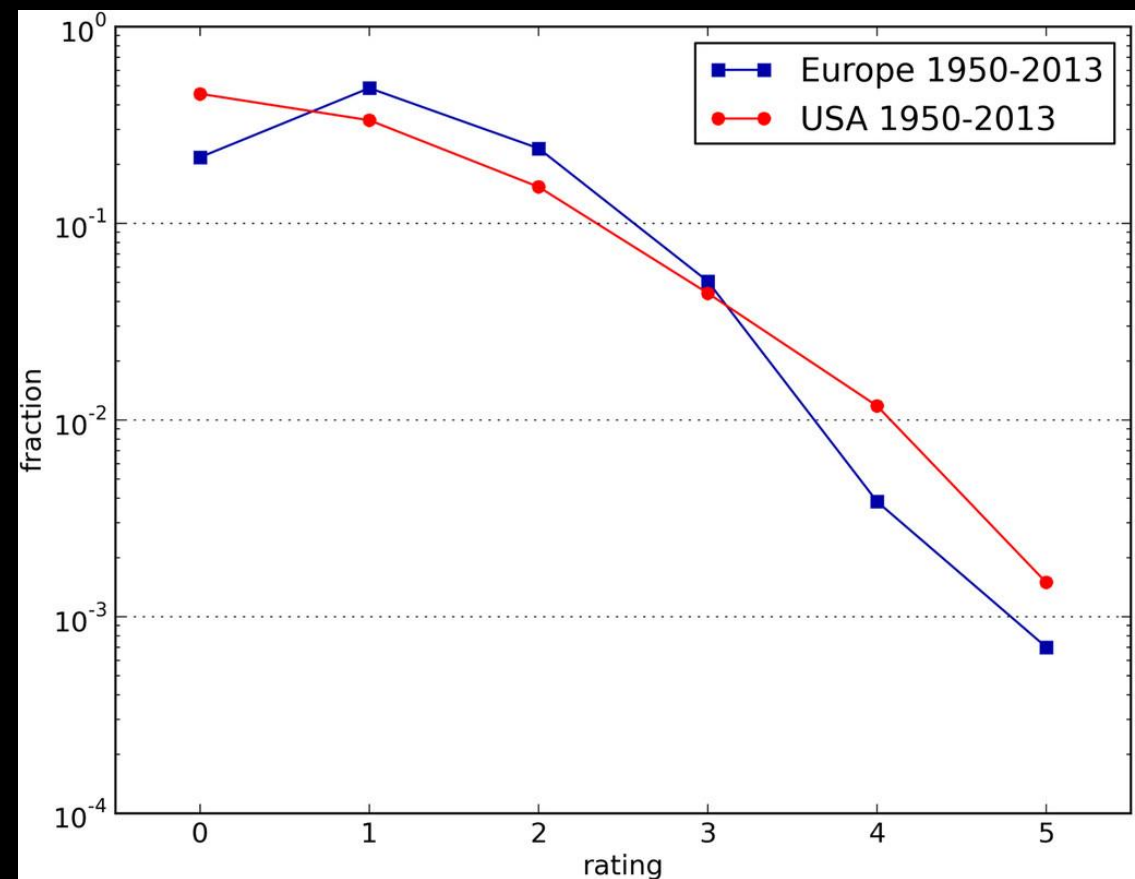
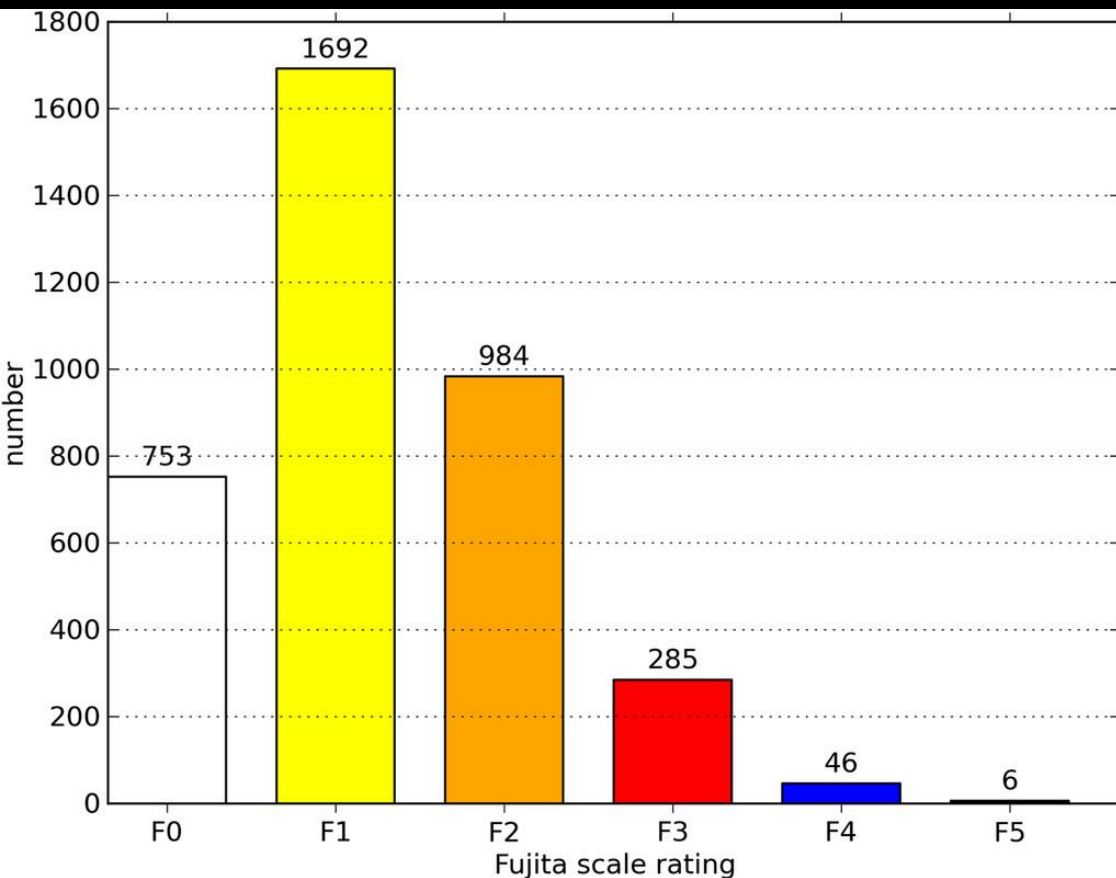
N 050°15'23.18" E 003°54'08.06" 05082008 163225 P-E110 S----- 166m VT QTH:hautmont (c) hs-winfo.eu



Statistical perspective



Statistical perspective



At what height do we observe the strongest wind in tornadoes?

- A. > 100 m AGL**
- B. $50 - 100$ m AGL**
- C. $10 - 50$ m AGL**
- D. < 10 m AGL**

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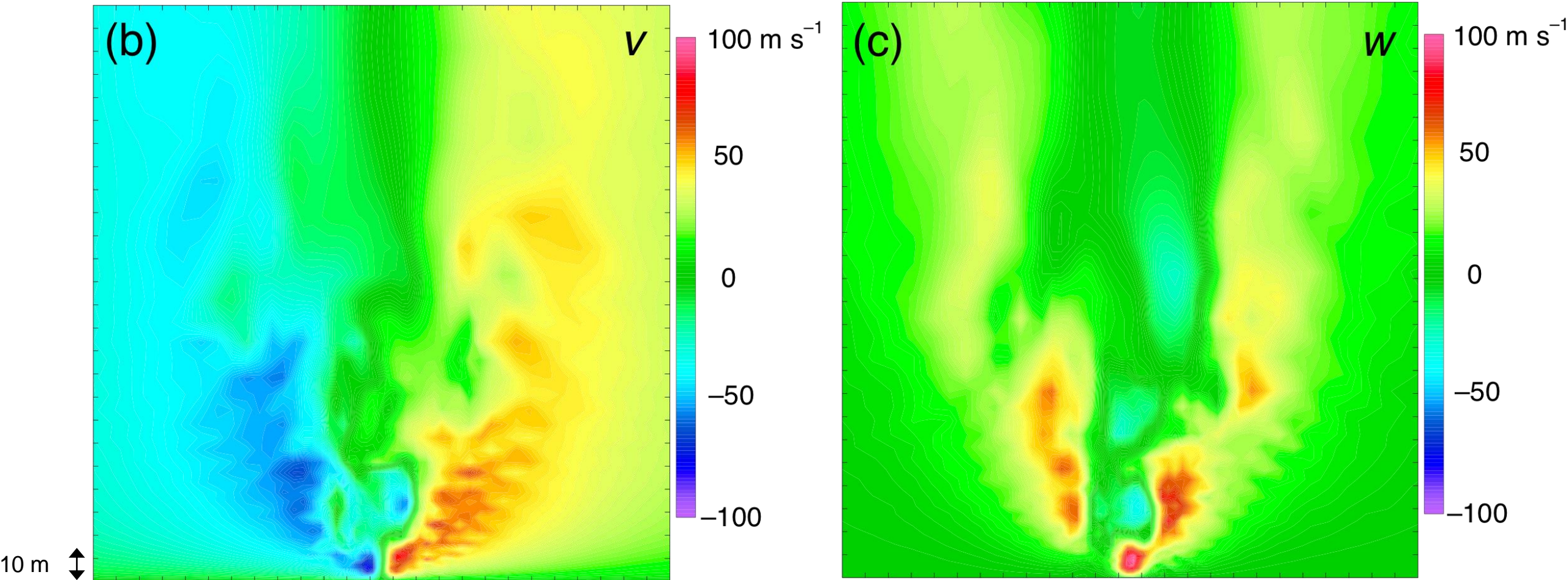
A. > 100 m AGL

B. 50 – 100 m AGL

C. 10 – 50 m AGL

D. < 10 m AGL

Windspeeds in tornadoes



Simulation by David Lewellen

Windspeeds in tornadoes

Strongest wind typically < 10 m AGL



Windspeeds in tornadoes

Significant vertical component of wind: debris lofting and its impact



Windspeeds in tornadoes

Significant vertical component of wind: debris lofting and its impact



24 June 2021 tornado

Impact of strong tornado windspeeds on hundreds of structures



Photo by
Lukas Ronge

24 June 2021 tornado

Examples of violent tornado damage



24 June 2021 tornado

Examples of violent tornado damage





Which of the following applies in case of strong tornado

- A. Take shelter in a sturdy building**
- B. Try to drive away from the tornado**
- C. If caught in the vehicle, stay in it**
- D. Shelter in an interior room without windows**
- E. You need to be underground, or you die**
- F. Film it and become a famous youtuber**

Which of the following applies in case of strong tornado

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How does this compare to the **generic impact texts**
for severe wind gusts?

24 June 2021: extent of severe weather outbreak

500 hPa height
and temperature

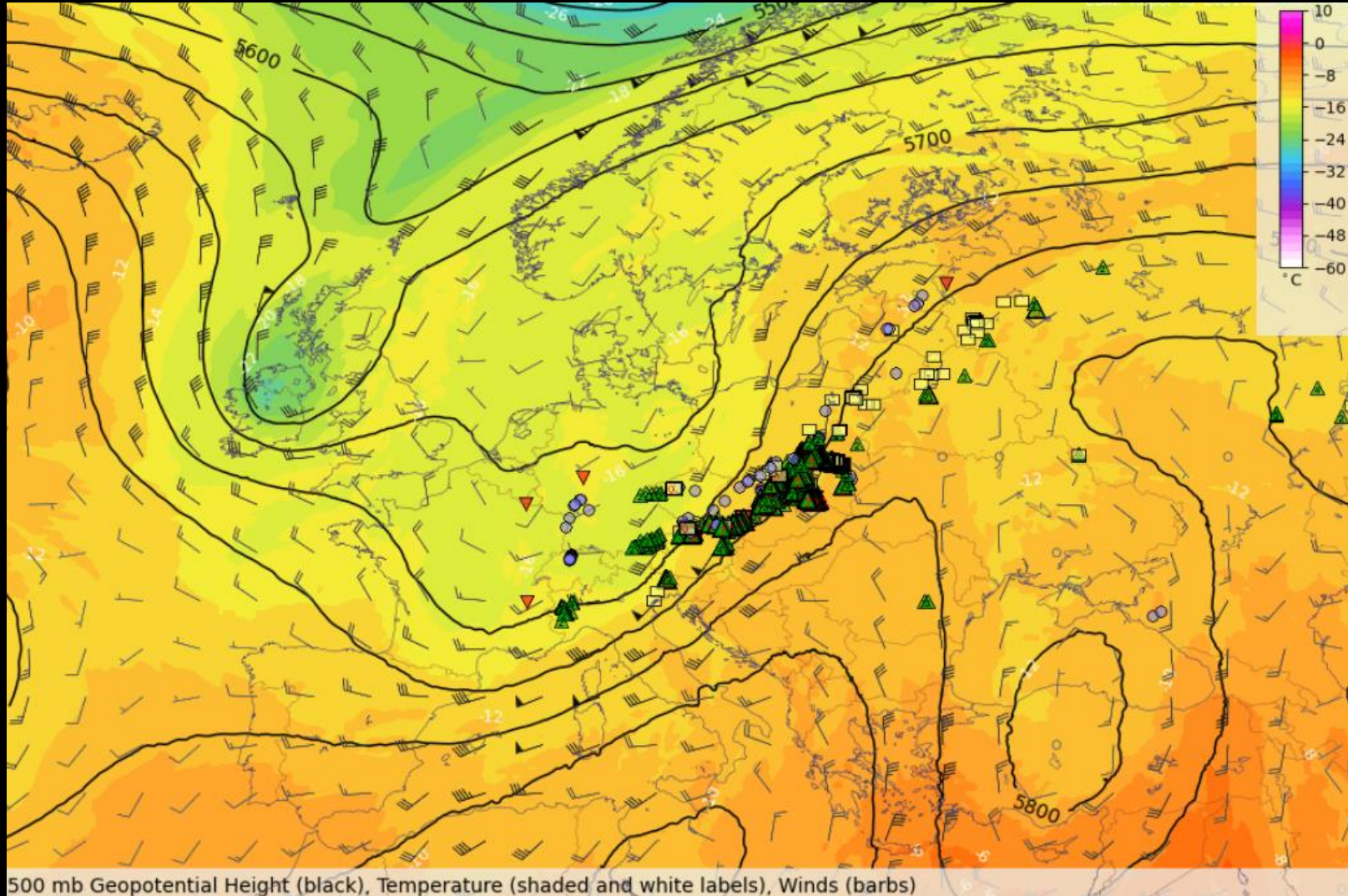
ESWD reports

Hail:
green triangles

Heavy Rain:
blue dots

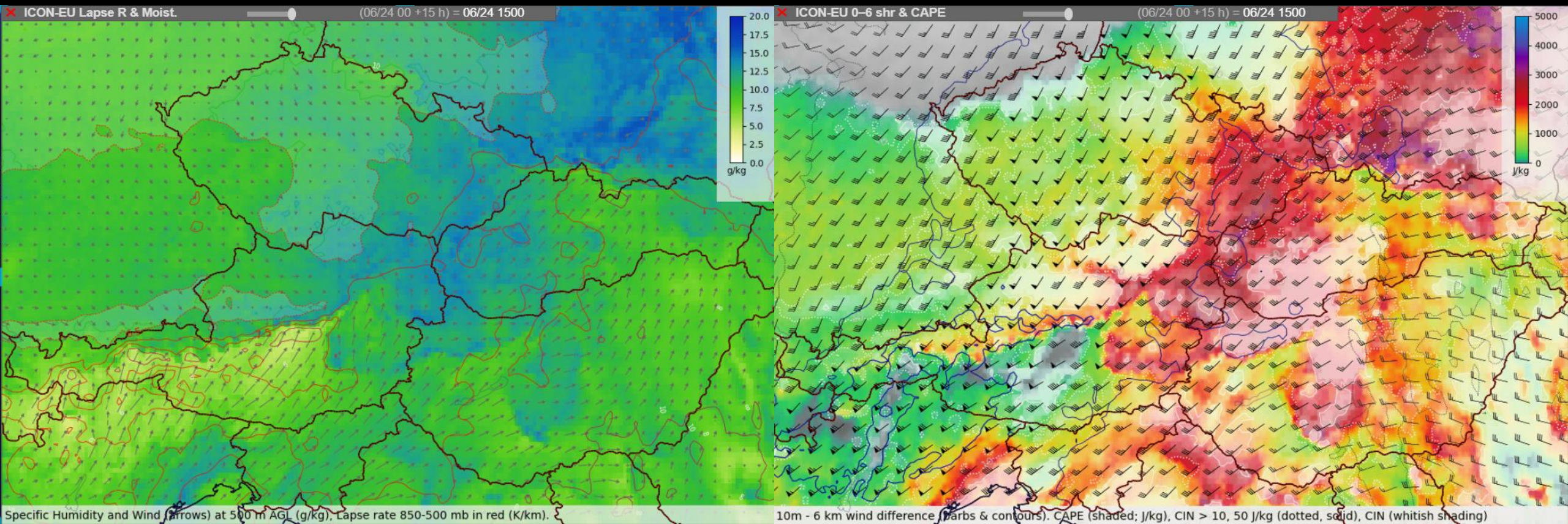
Tornadoes:
red triangles

Wind:
Yellow rectangles



500 mb Geopotential Height (black), Temperature (shaded and white labels), Winds (barbs)

24 June 2021



What else to consider for strong tornadoes?

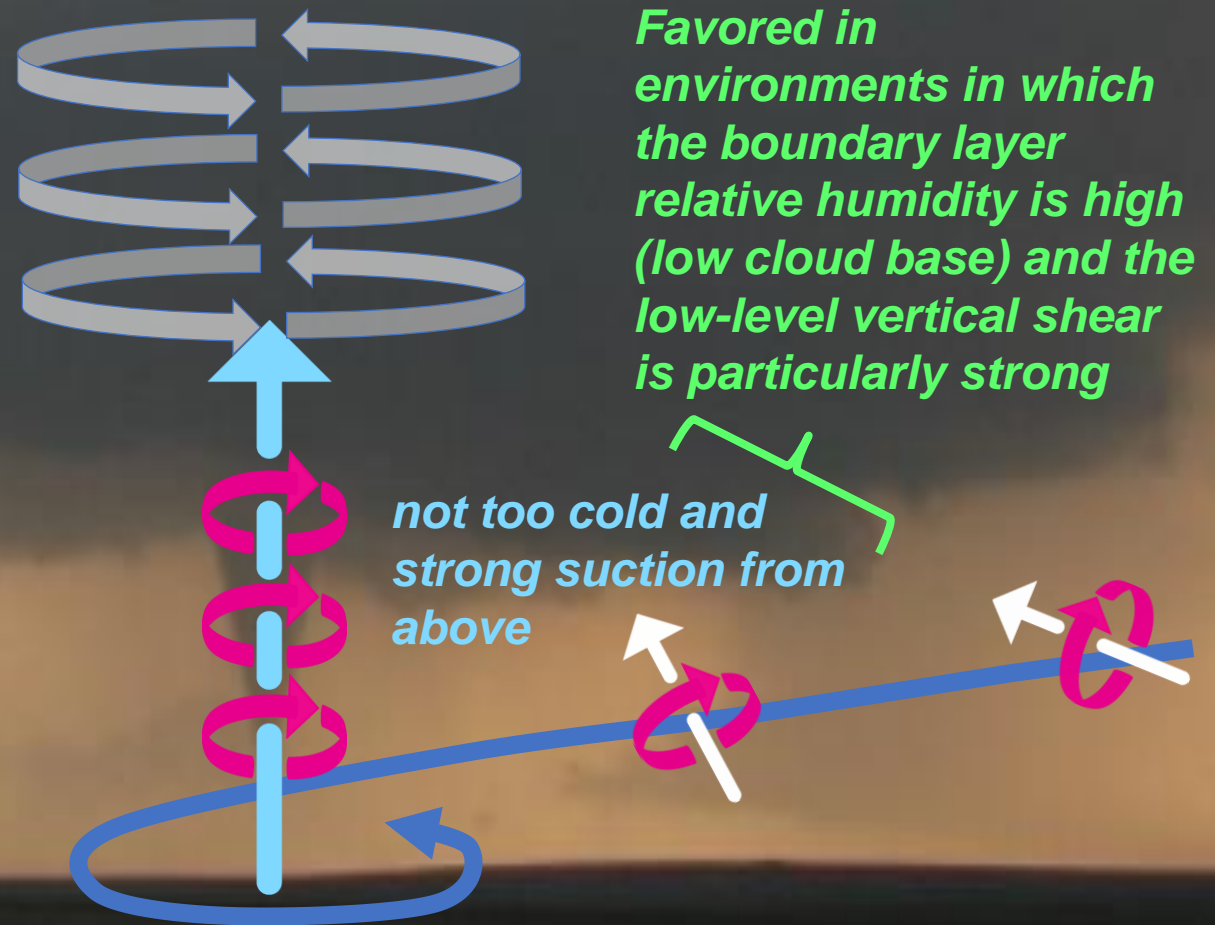
- A. CAPE > 3000 J/kg**
- B. High cloud bases**
- C. Low cloud bases**
- D. Strong shear in the upper troposphere**
- E. Strong shear in the lower troposphere**
- F. Surface boundary present**

What else to consider for strong tornadoes?

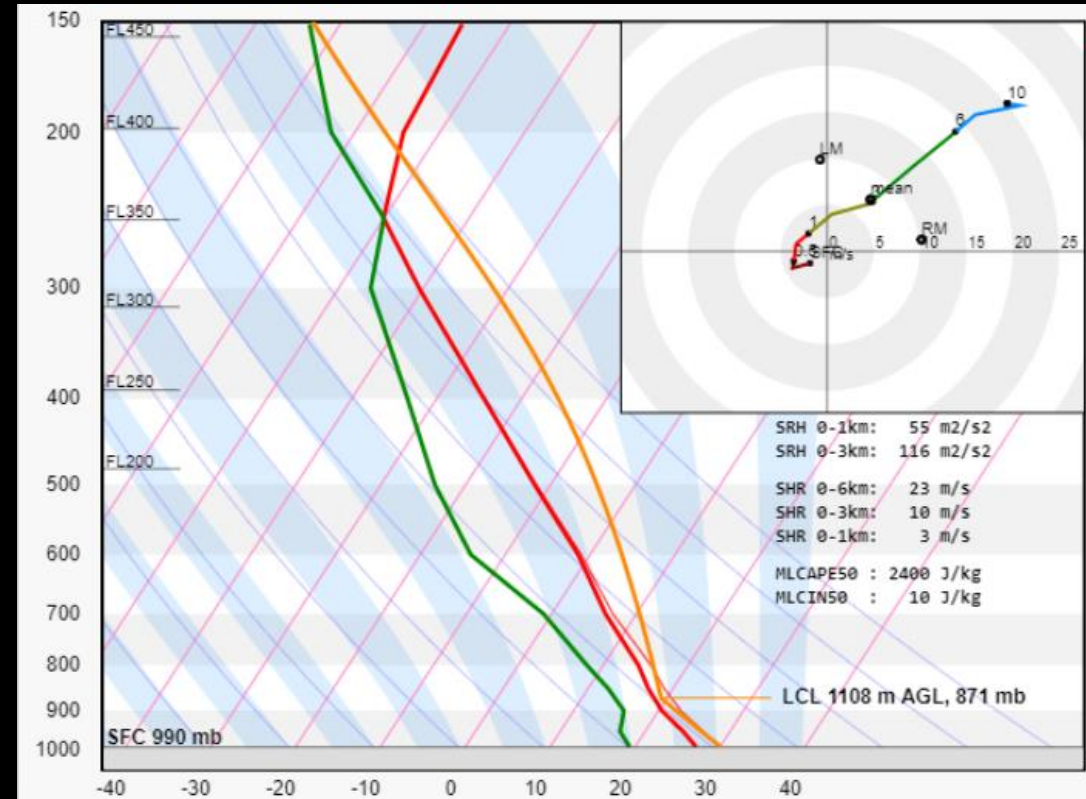
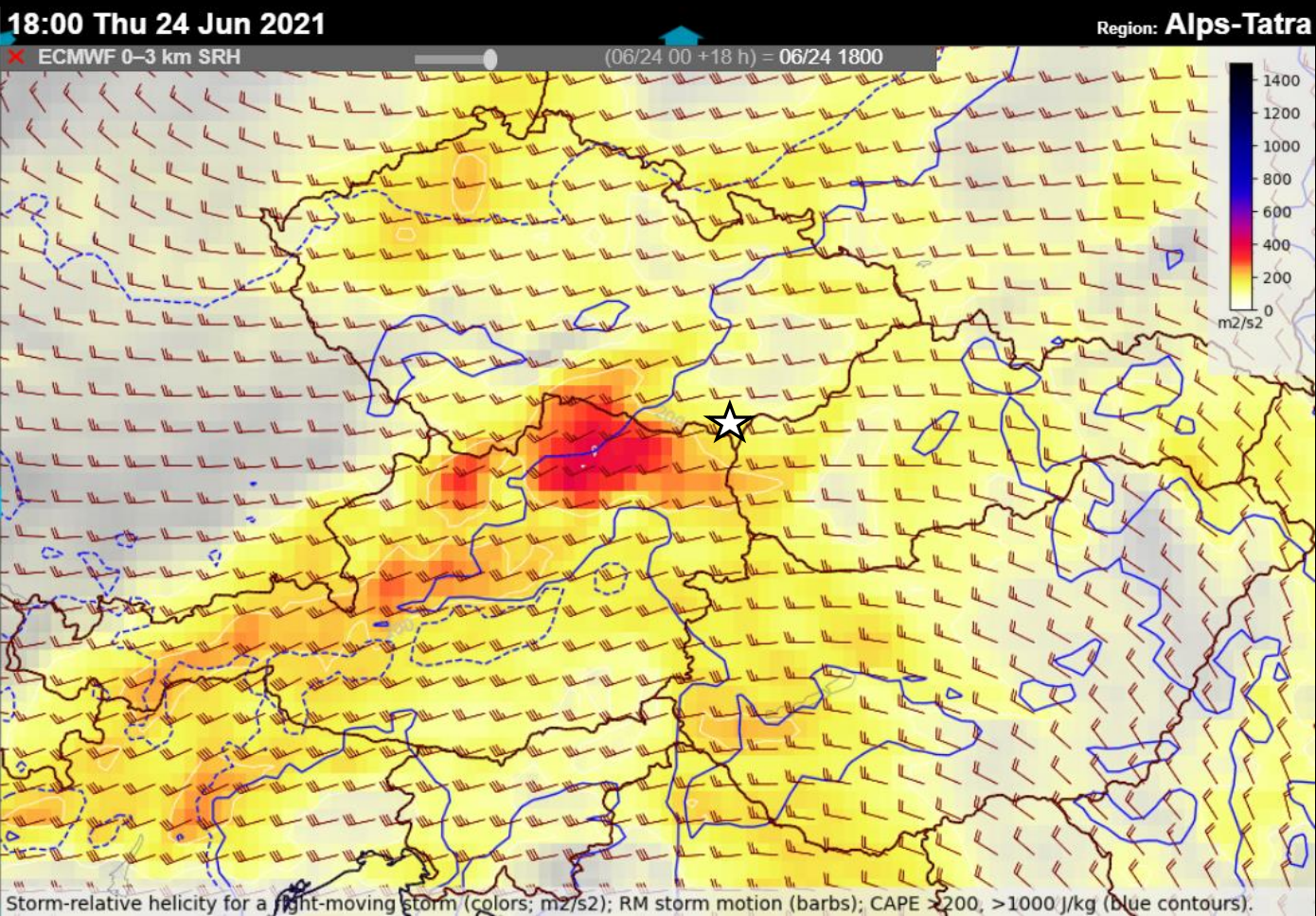
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Tornadogenesis in supercells

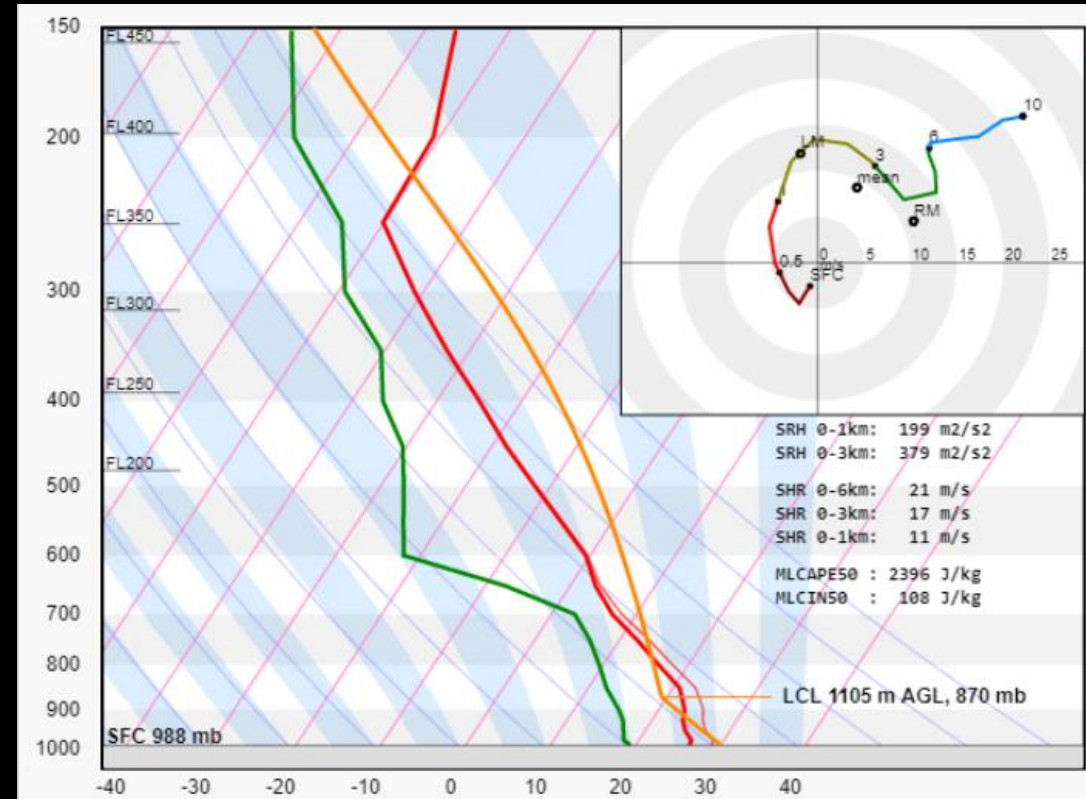
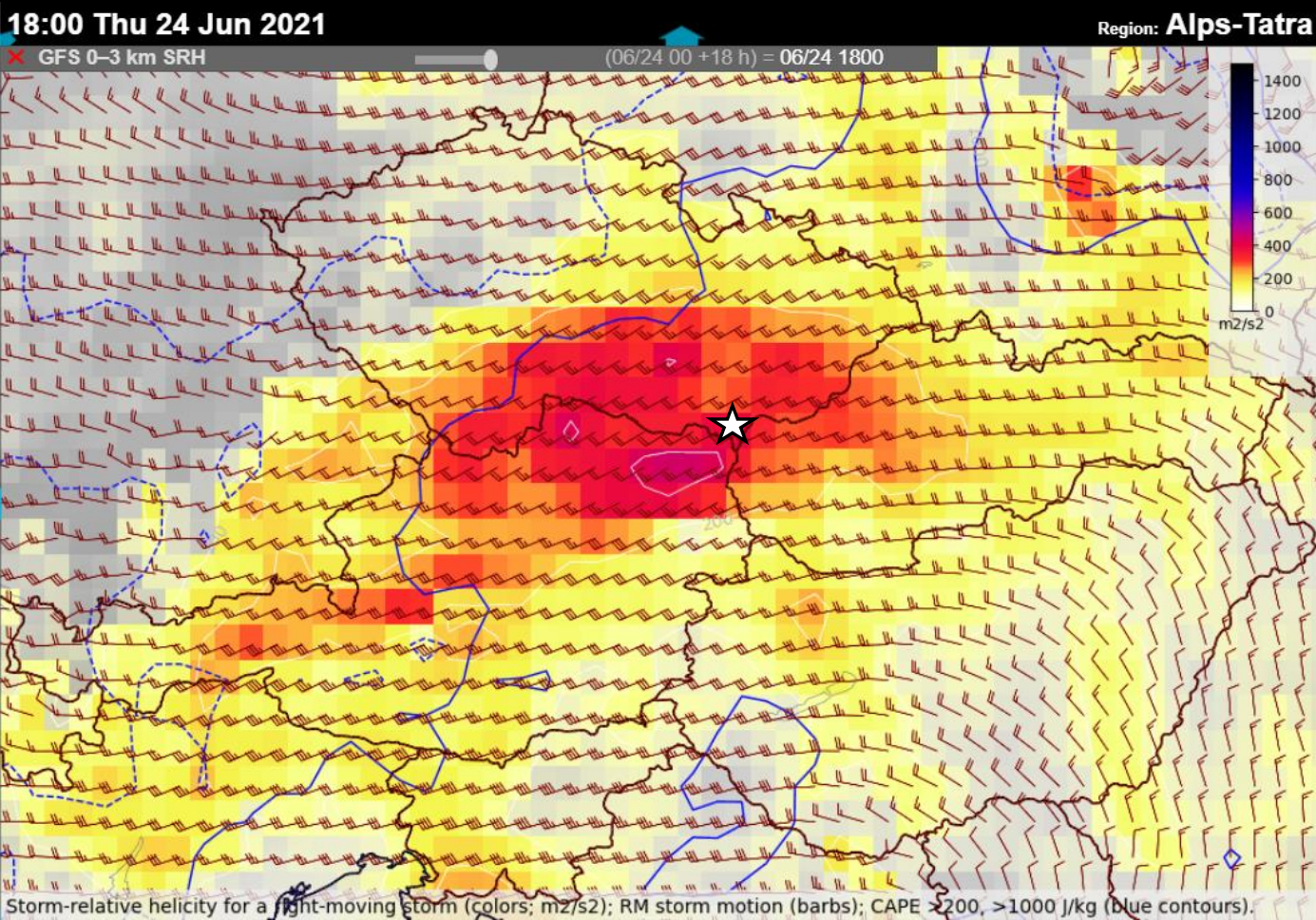
Courtesy of Paul Markowski



Model data



Model data



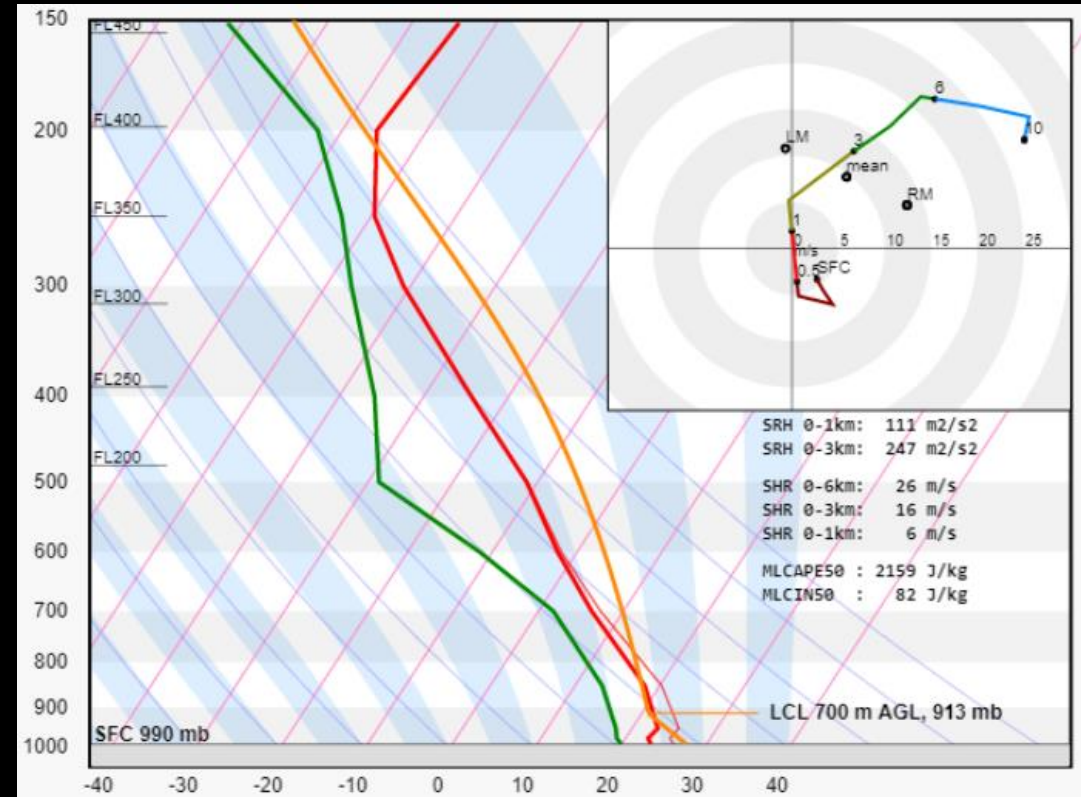
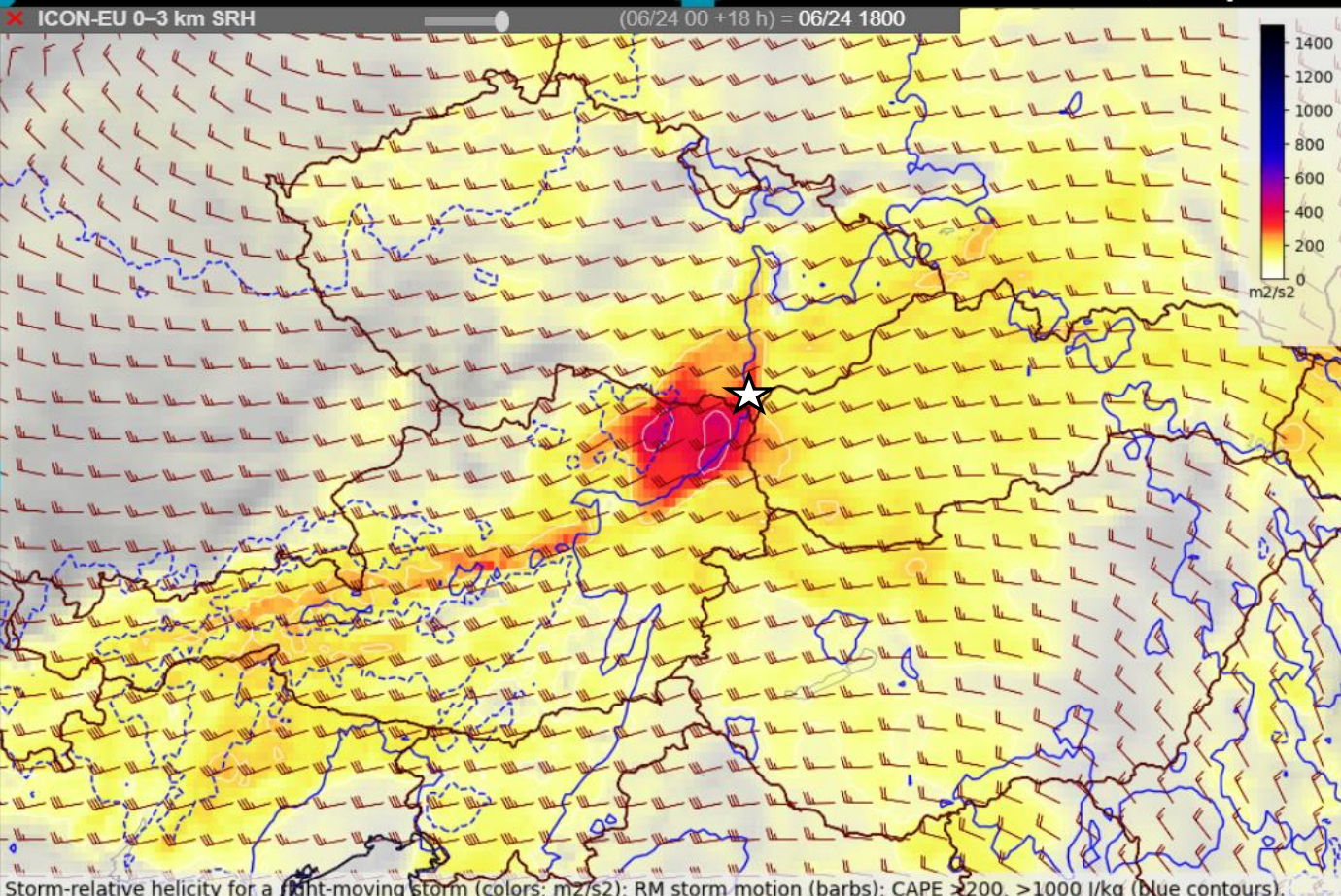
Model data

18:00 Thu 24 Jun 2021

ICON-EU 0-3 km SRH

(06/24 00 +18 h) = 06/24 1800

Region: Alps-Tatra



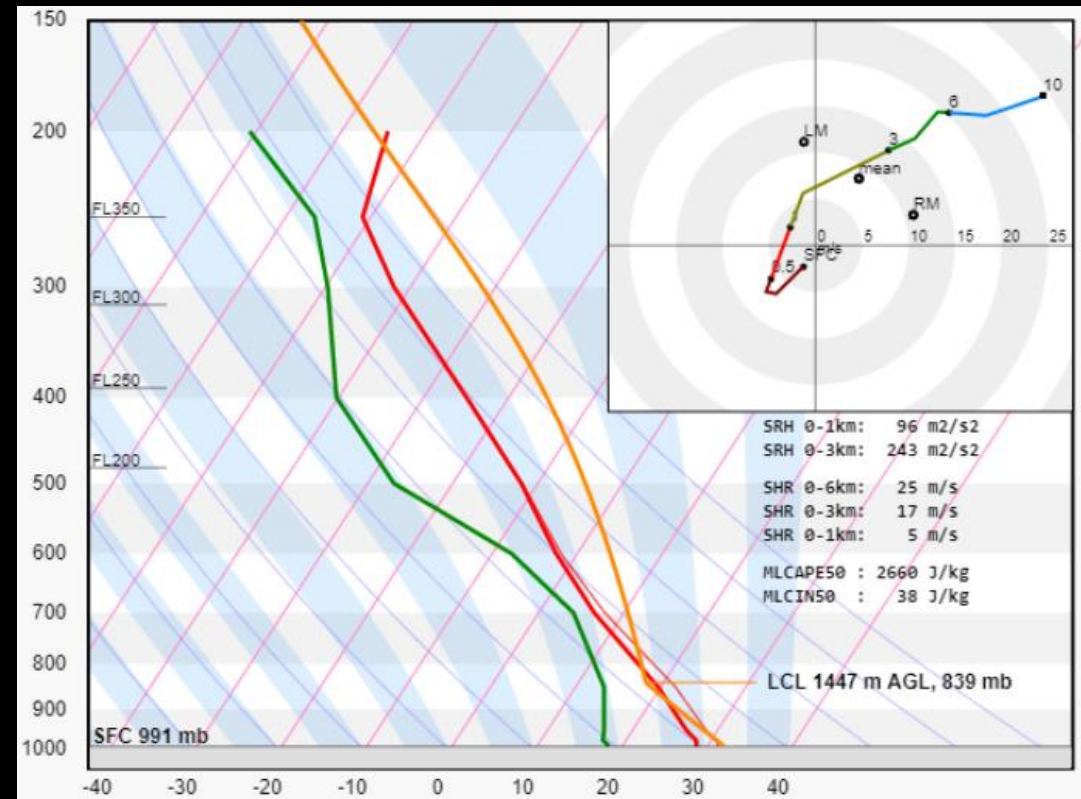
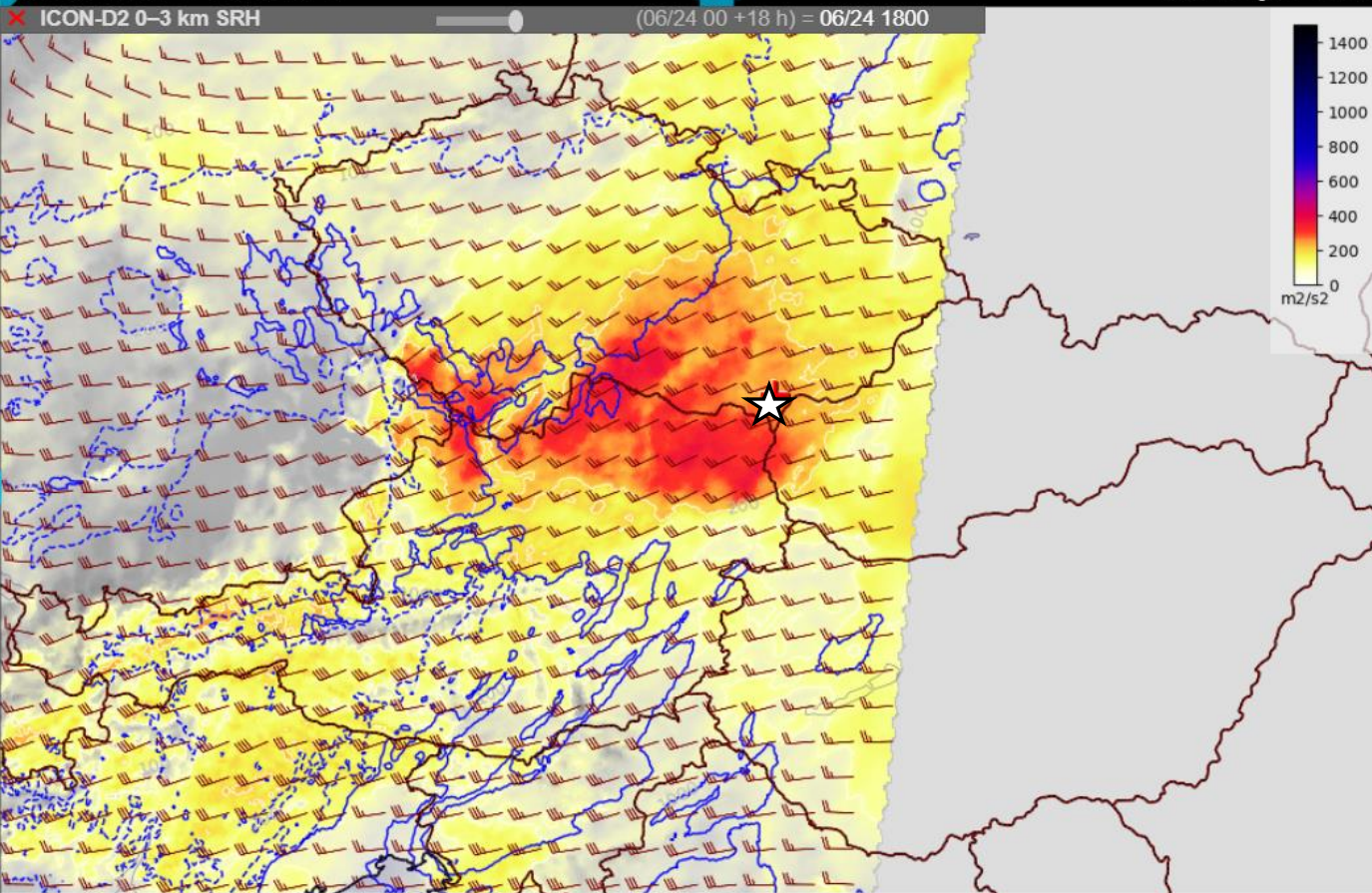
Model data

18:00 Thu 24 Jun 2021

ICON-D2 0-3 km SRH

(06/24 00 +18 h) = 06/24 1800

Region: Alps-Tatra



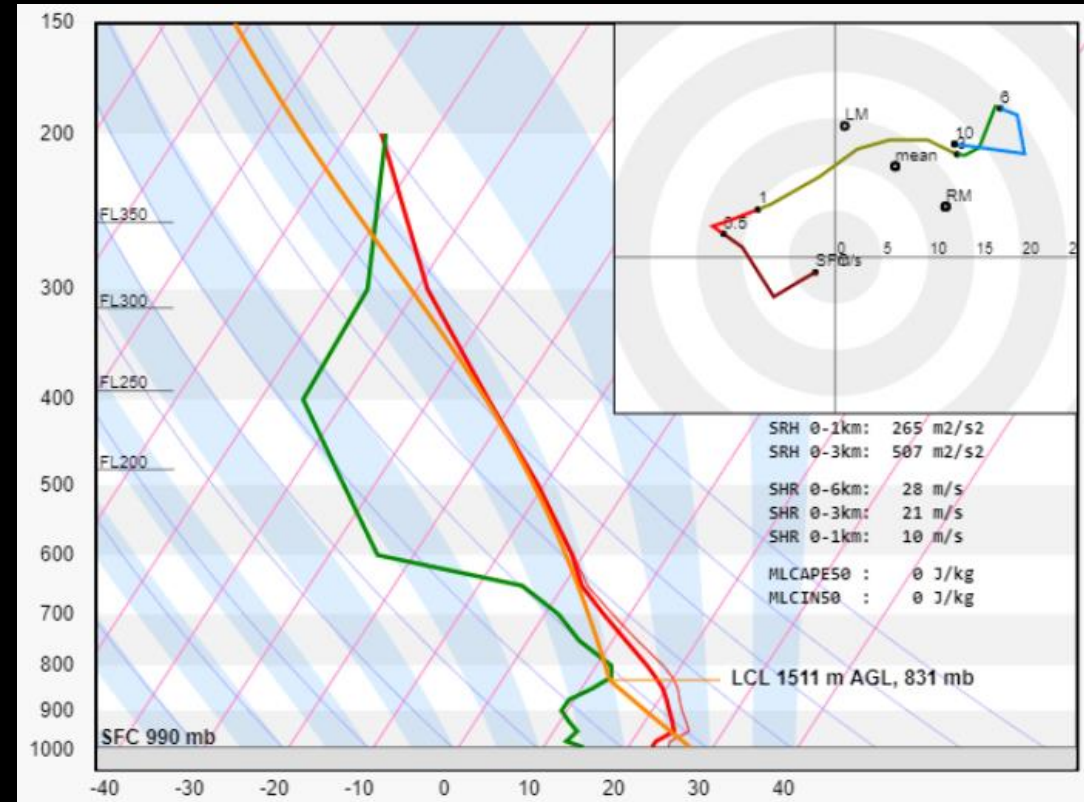
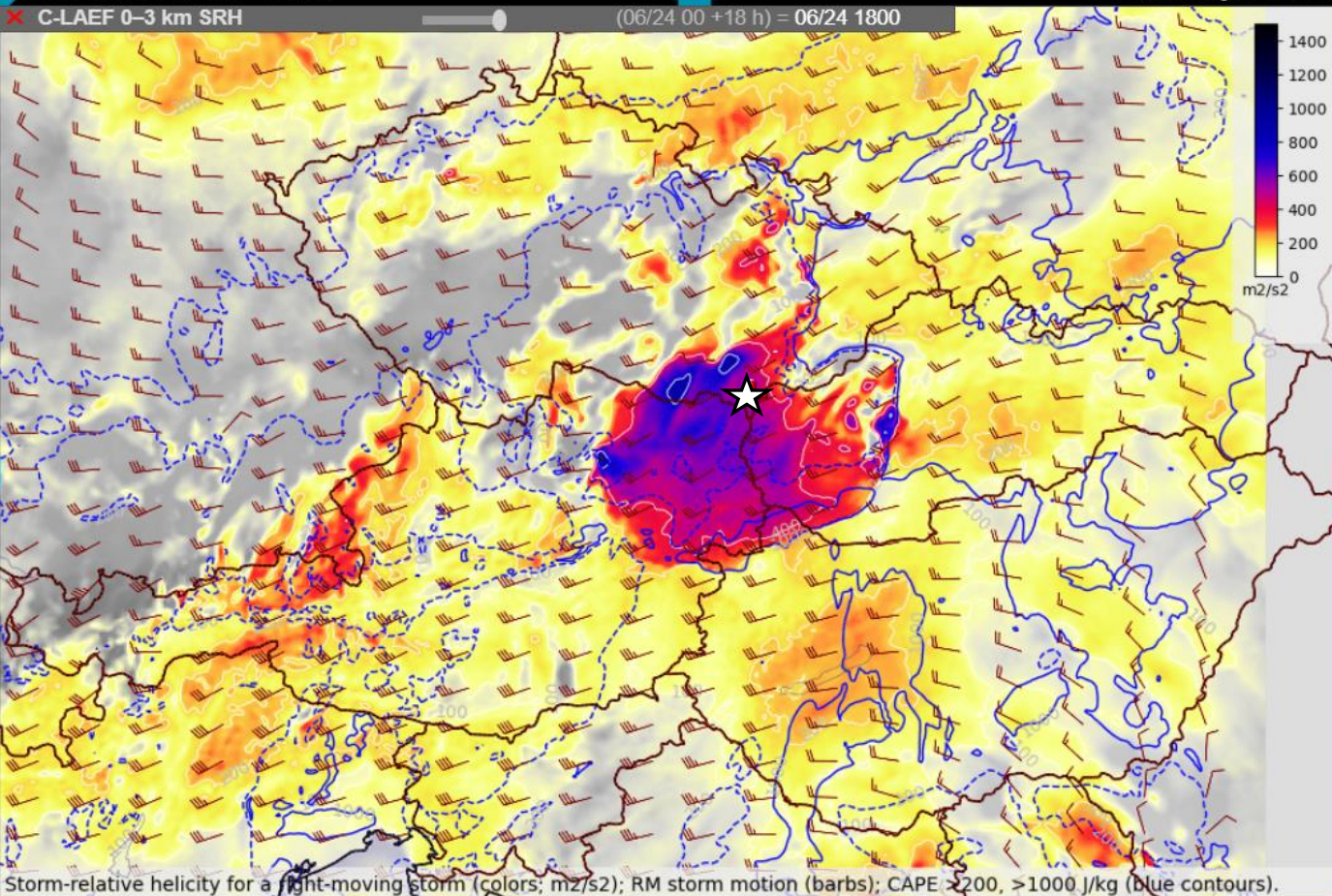
Model data

18:00 Thu 24 Jun 2021

× C-LAEF 0–3 km SRH

(06/24 00 +18 h) = 06/24 1800

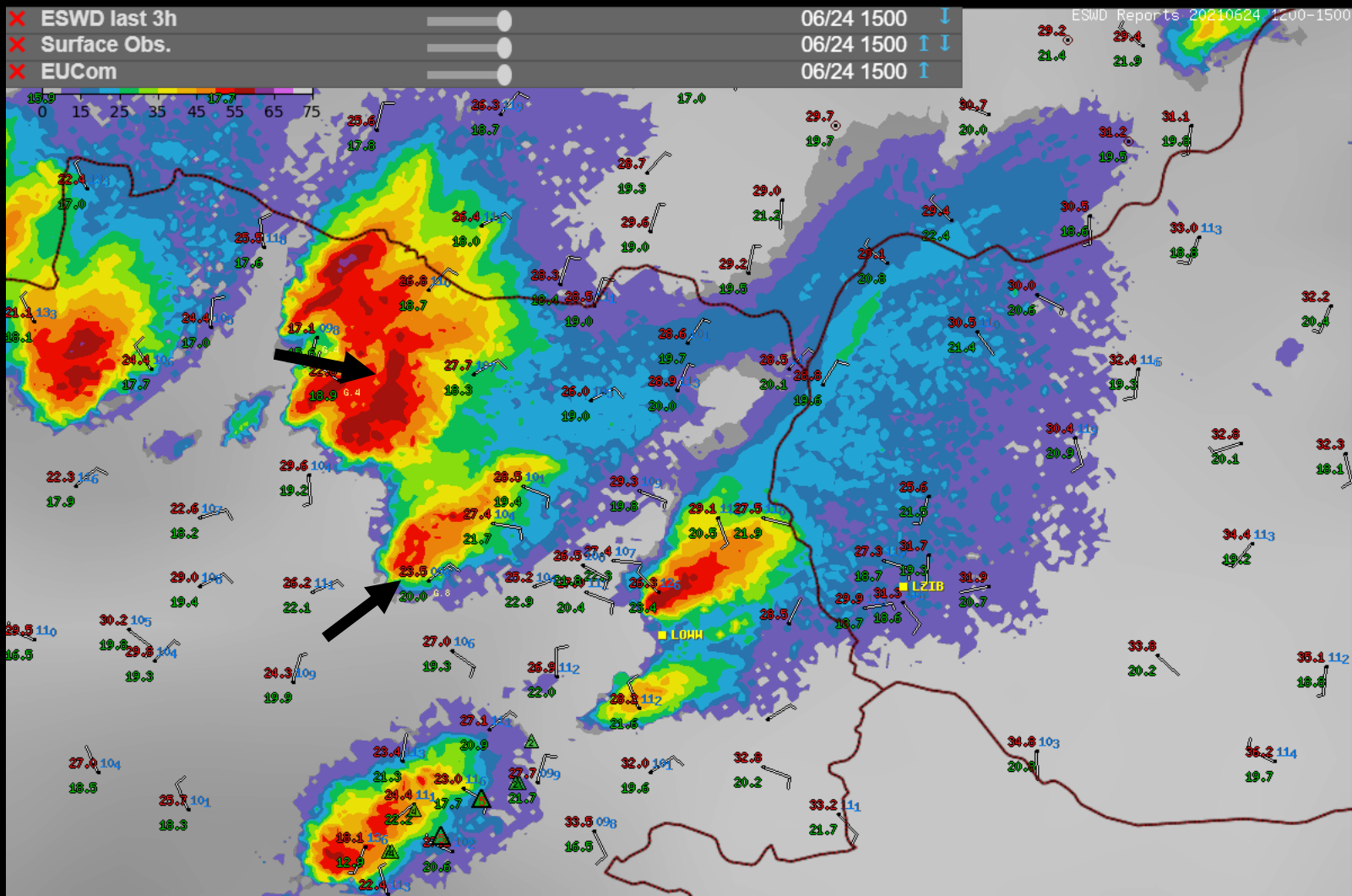
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Mesoscale evolution

15:00 Thu 24 Jun 2021

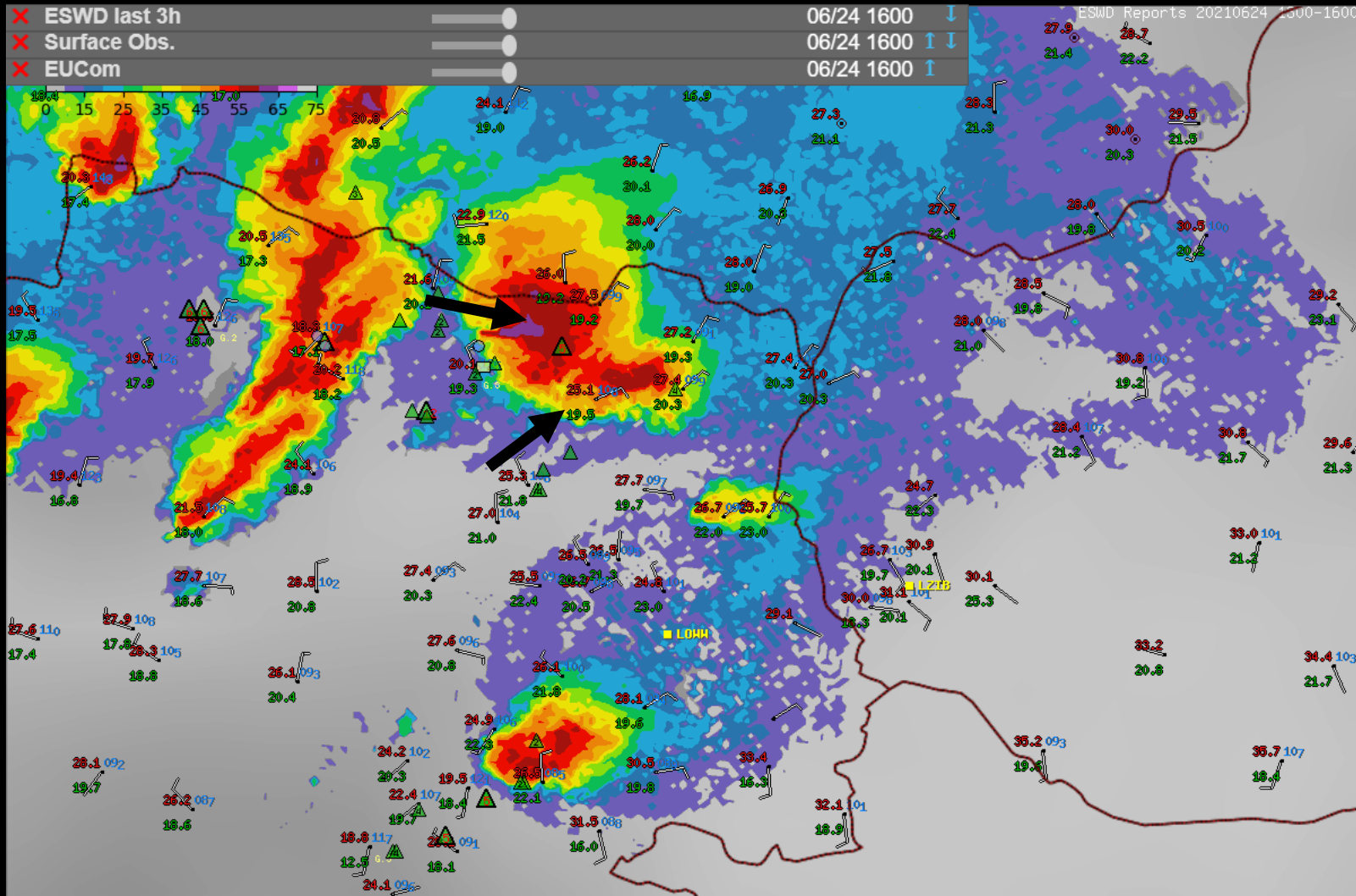
Region: MoraviaT2



Mesoscale evolution

16:00 Thu 24 Jun 2021

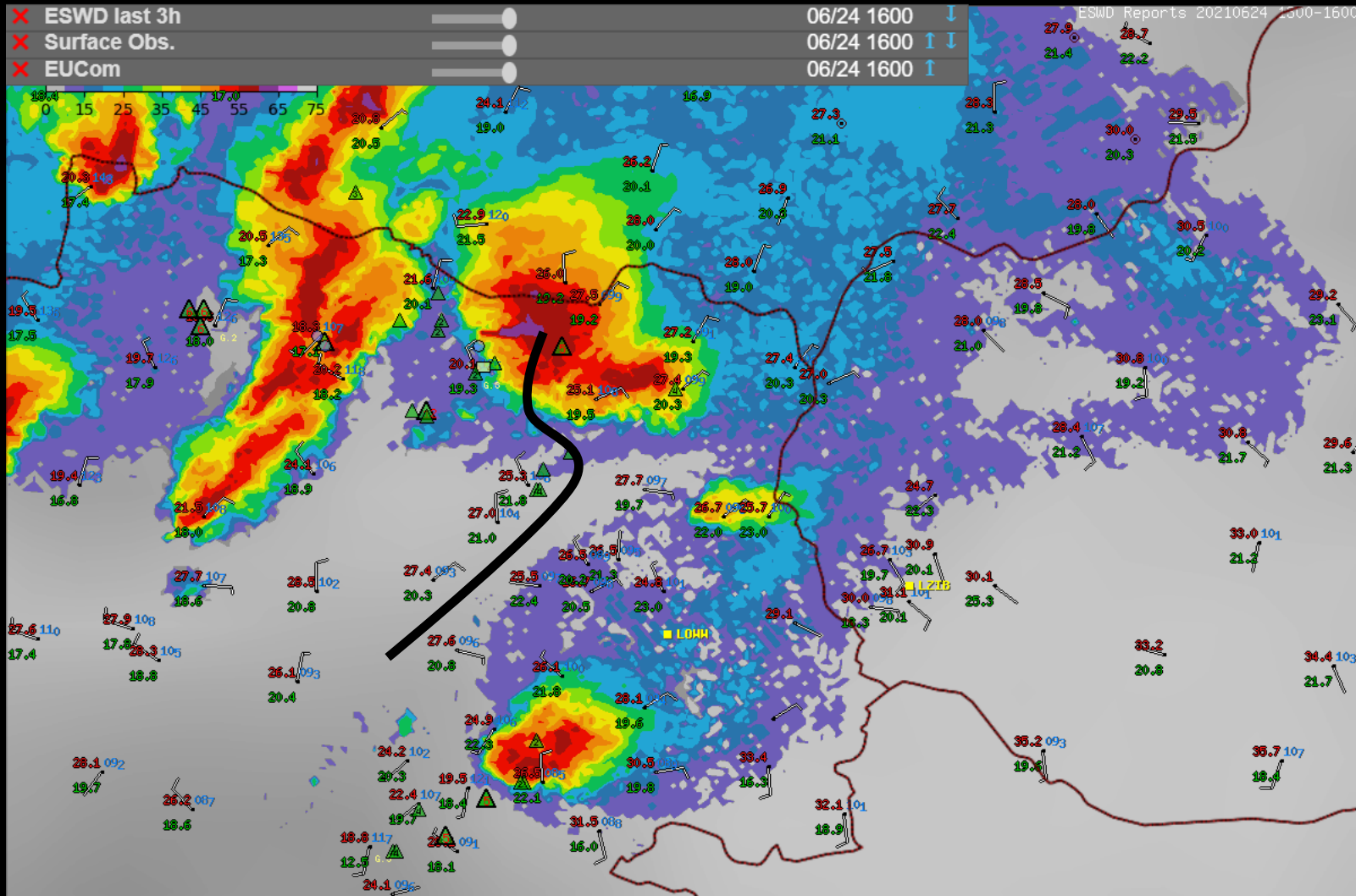
Region: MoraviaT2

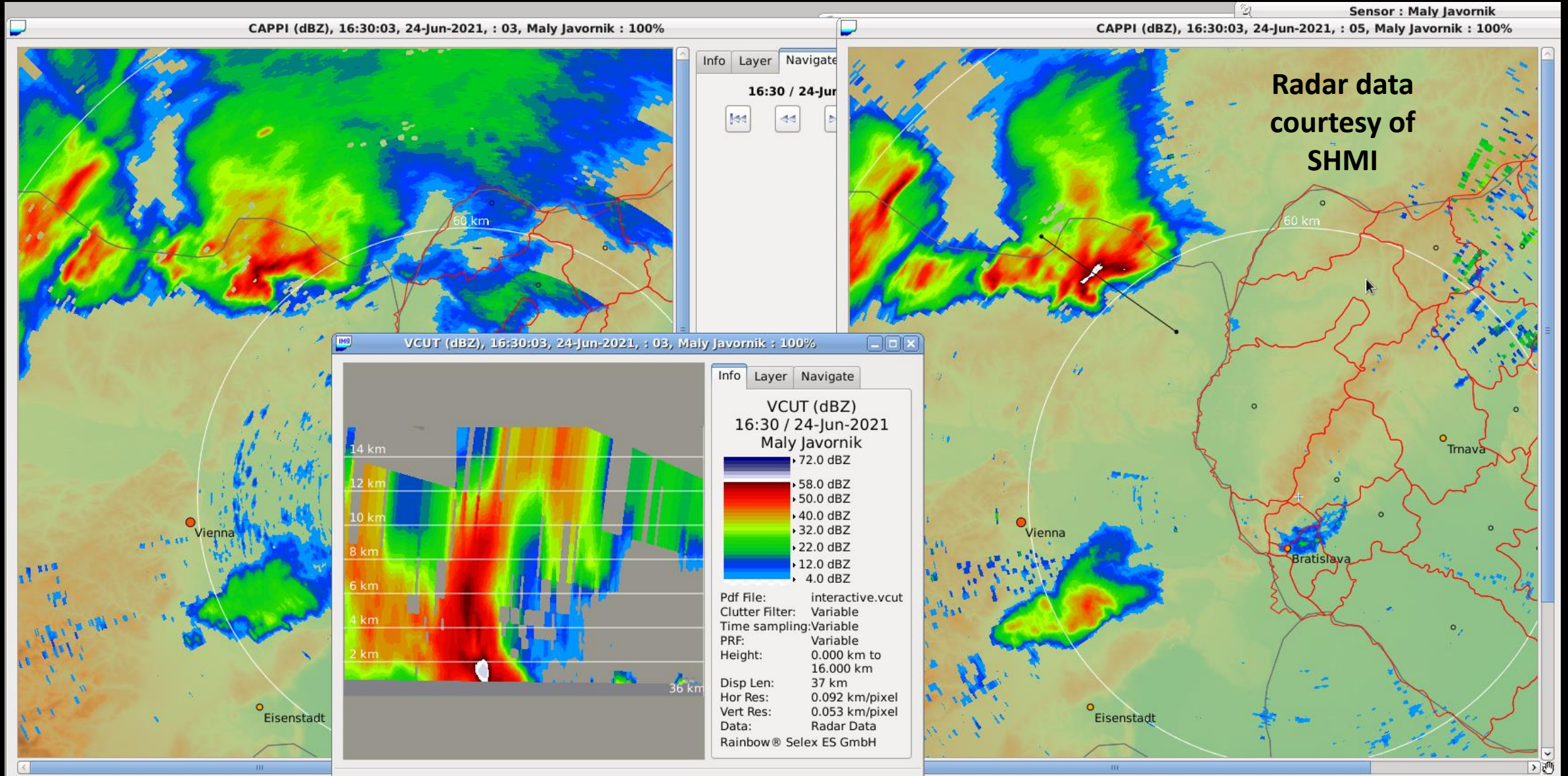


Mesoscale evolution

16:00 Thu 24 Jun 2021

Region: MoraviaT2





Lessons learned? from the 24 June 2021 tornado

Violent tornadoes can occur outside of the tornado “hotspots” in Europe.

Do the generic warning impact texts cover the scope of the threat?

Damage survey coordination in event of such a scale is difficult.

Mesoscale evolution can play a significant role, especially in volatile high CAPE setups.

Questions? Comments? Contact me at tomas.pucik@essl.org