2.5 min rapid scans: 20120912 case study in NE Italy - a supercell outbreak

Agostino Manzato[1], Martin Setvák[2], Silvio Davolio[3], Mario Marcello Miglietta[3], Arturo Pucillo[1]

[1]OSMER - ARPA Friuli Venezia Giulia
[2]CHMU - Czech Hydrometeorological Institute
[3]ISAC - CNR Italy

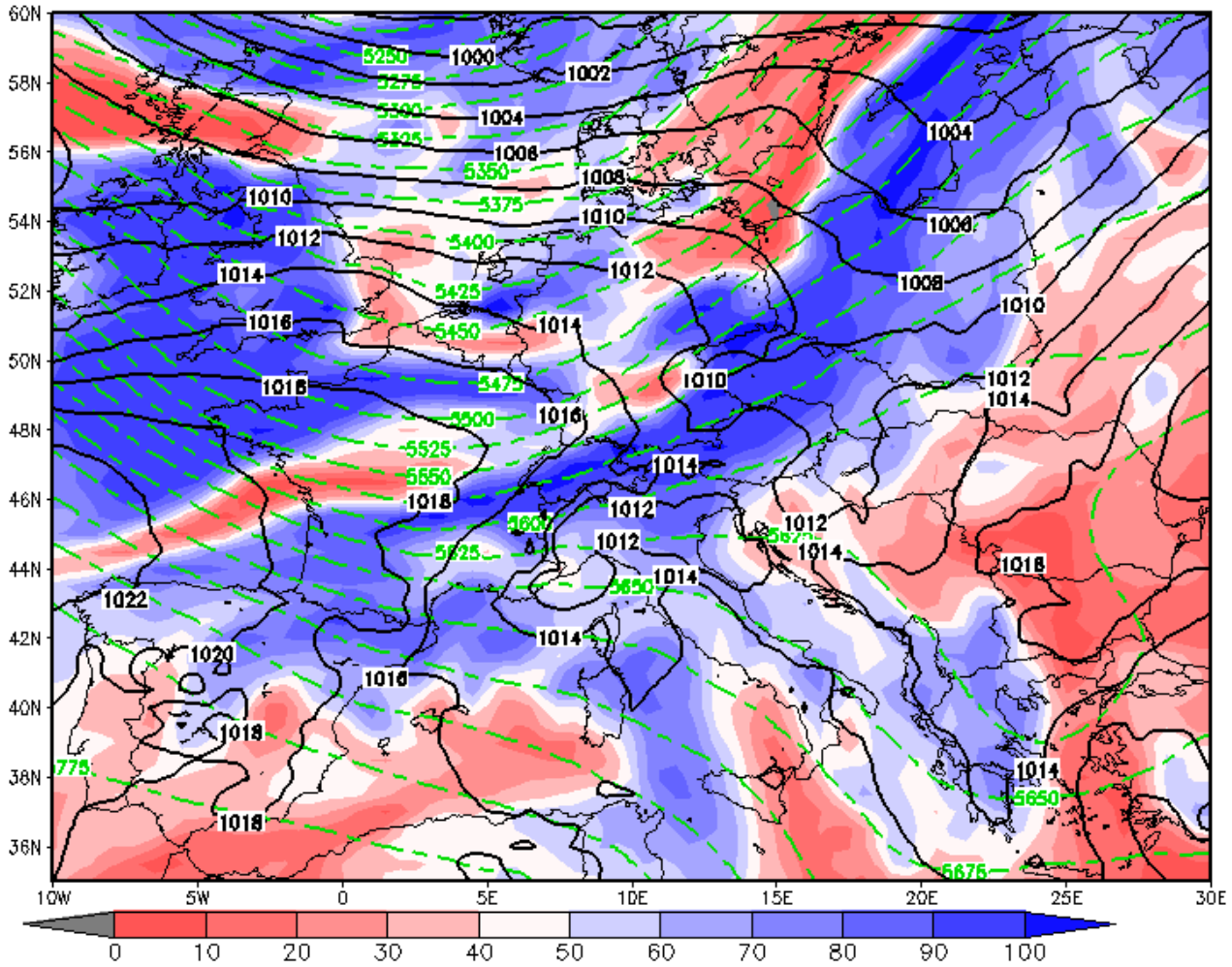
CWG Workshop - Zagreb 10 April 2014

Introduction

1. On 12 September 2012 (HyMeX IOP2) a series of severe weather episodes hit NE Italy (manuscript under review).
2. Among these episodes, the most interesting is that occurring between 07:00 and 11:00 UTC, since it is associated with a peculiar interaction between two cells.
3. Until 09:00 UTC also 2.5-minutes experimental MSG-3 rapid scan were collected and will be compared with the other observations (e.g. radar).
4. This case has been already discussed by Kerkmann, Setvák and Manzato 2012 *"Experimental 2.5-minute super rapid scans from MSG-3 capture a supercell storm above northern Italy (12 September 2012)"* available at: http://oiswww.eumetsat.org/WEBOPS/iotm/iotm/20120912_convection/20120912_convection.html

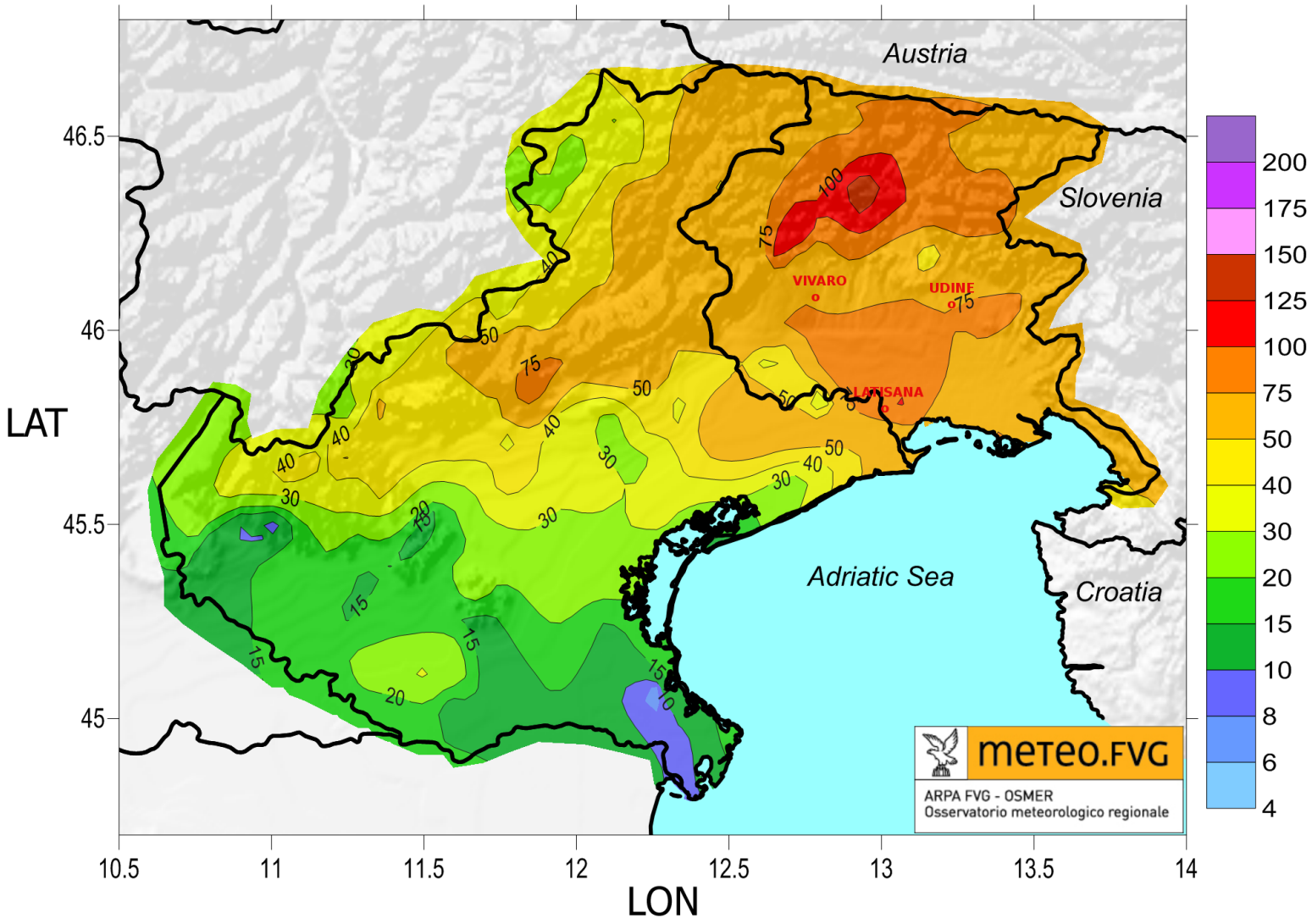
Synoptic situation

A North Atlantic trough moving southeastward in the morning of 12/09/2012, associated with the entrance of a cold front in NE Italy during the afternoon. Note the low-level cyclone in the Genoa gulf.



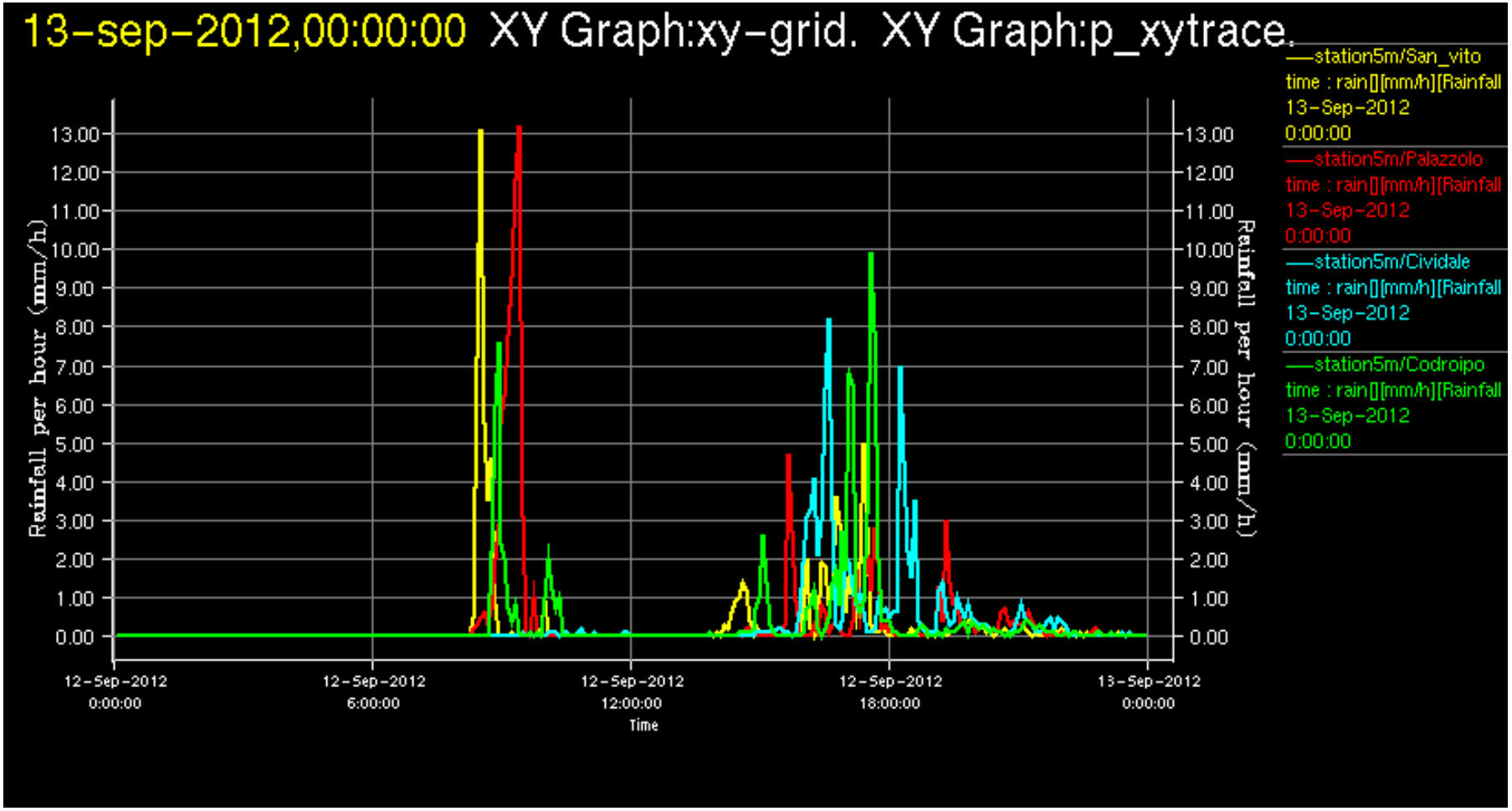
700 hPa RH; 500 hPa geopotential height and Mean Sea Level Pressure at 06:00 UTC of 12/09/2012.

Daily accumulated rainfall [mm in 24h]



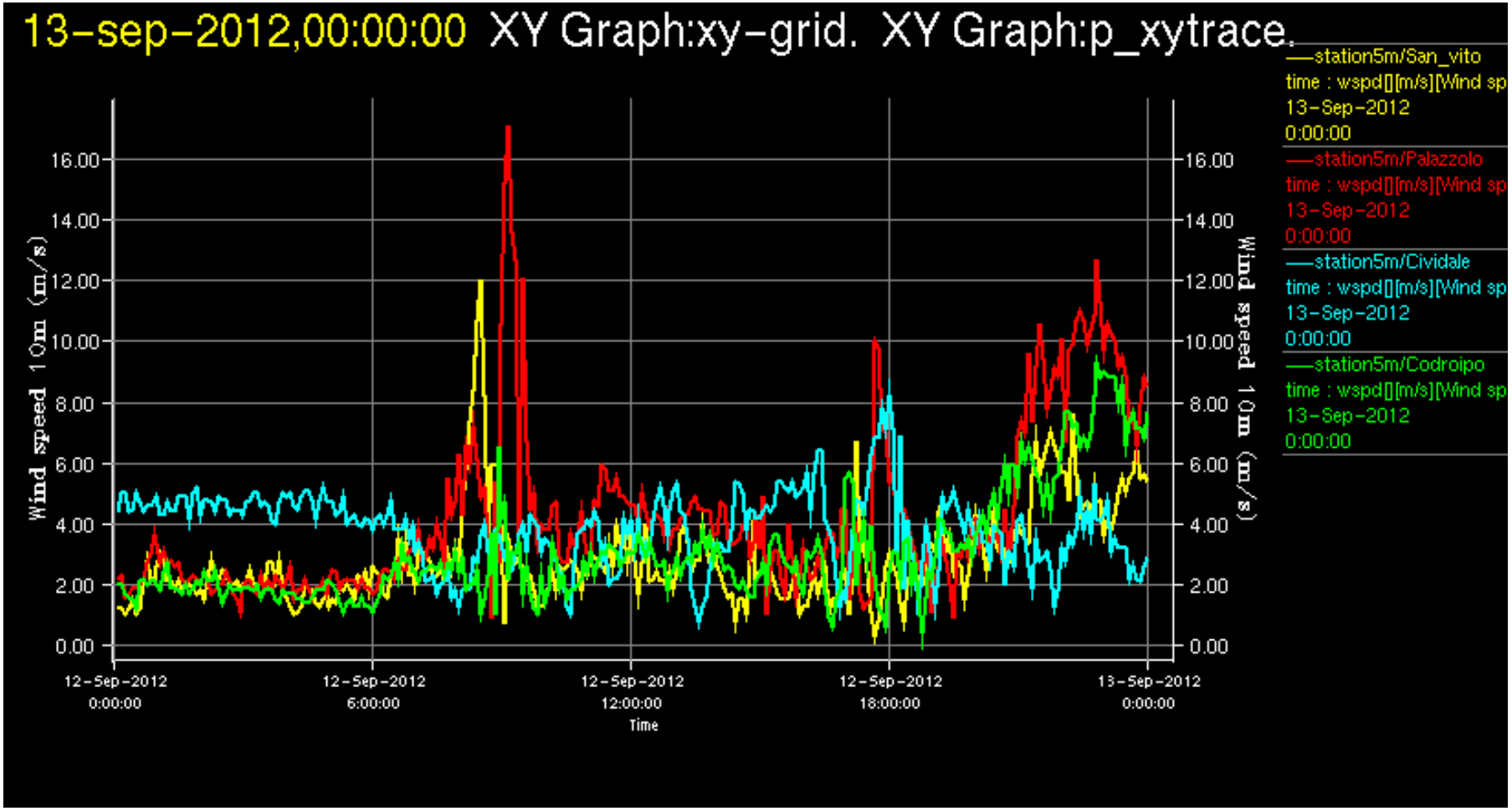
The morning case hit the area between Vivaro, Latisana and Udine.

5' accumulated rain in 4 stations of FVG plain [mm in 5']



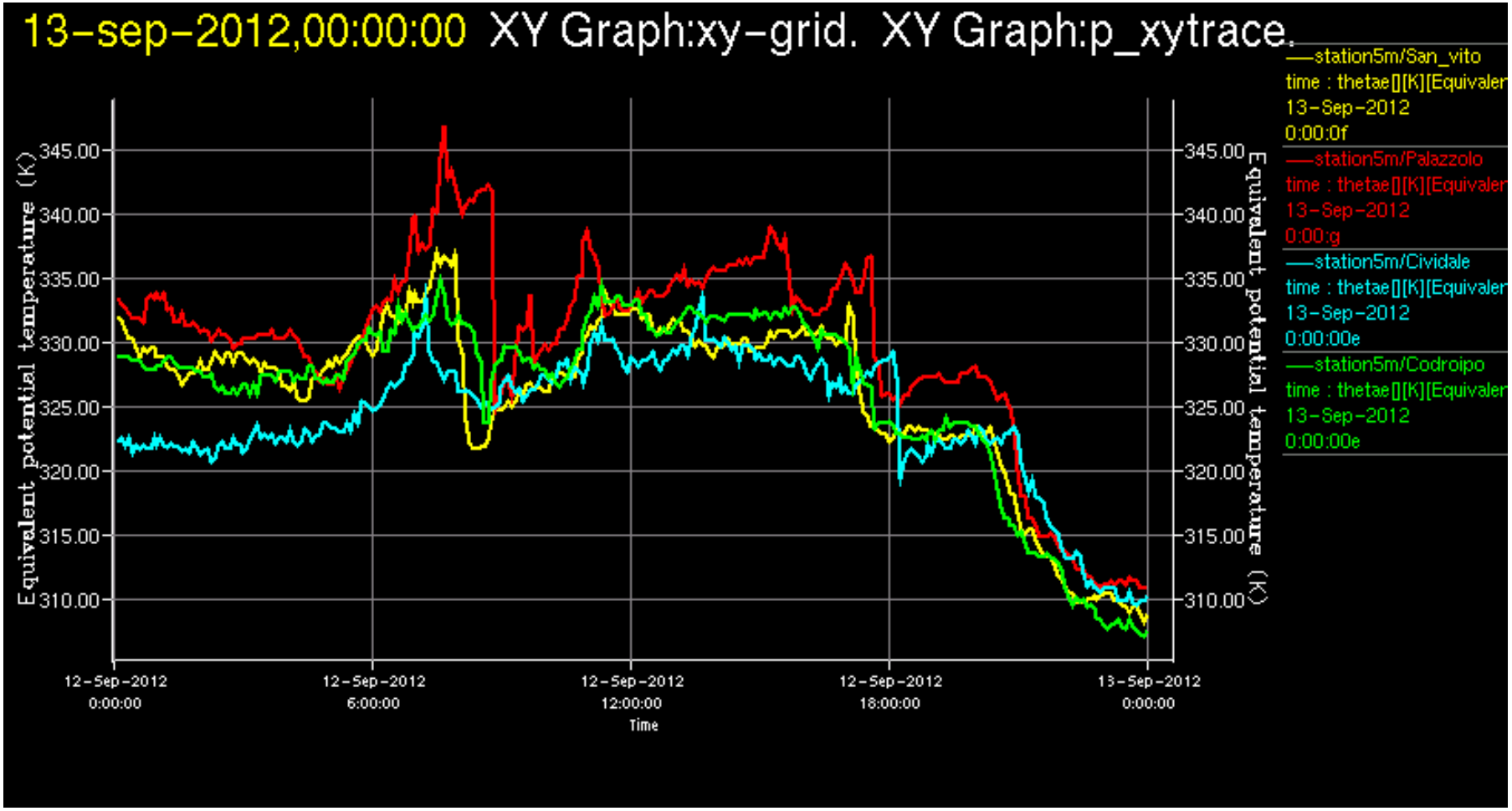
Palazzolo and San_Vito (located near Latisana) had peaks up to 13 mm/5'. Palazzolo had 52 mm between 09:00 and 10:00 UTC.

5' wind speed in 4 stations of FVG plain [m/s]



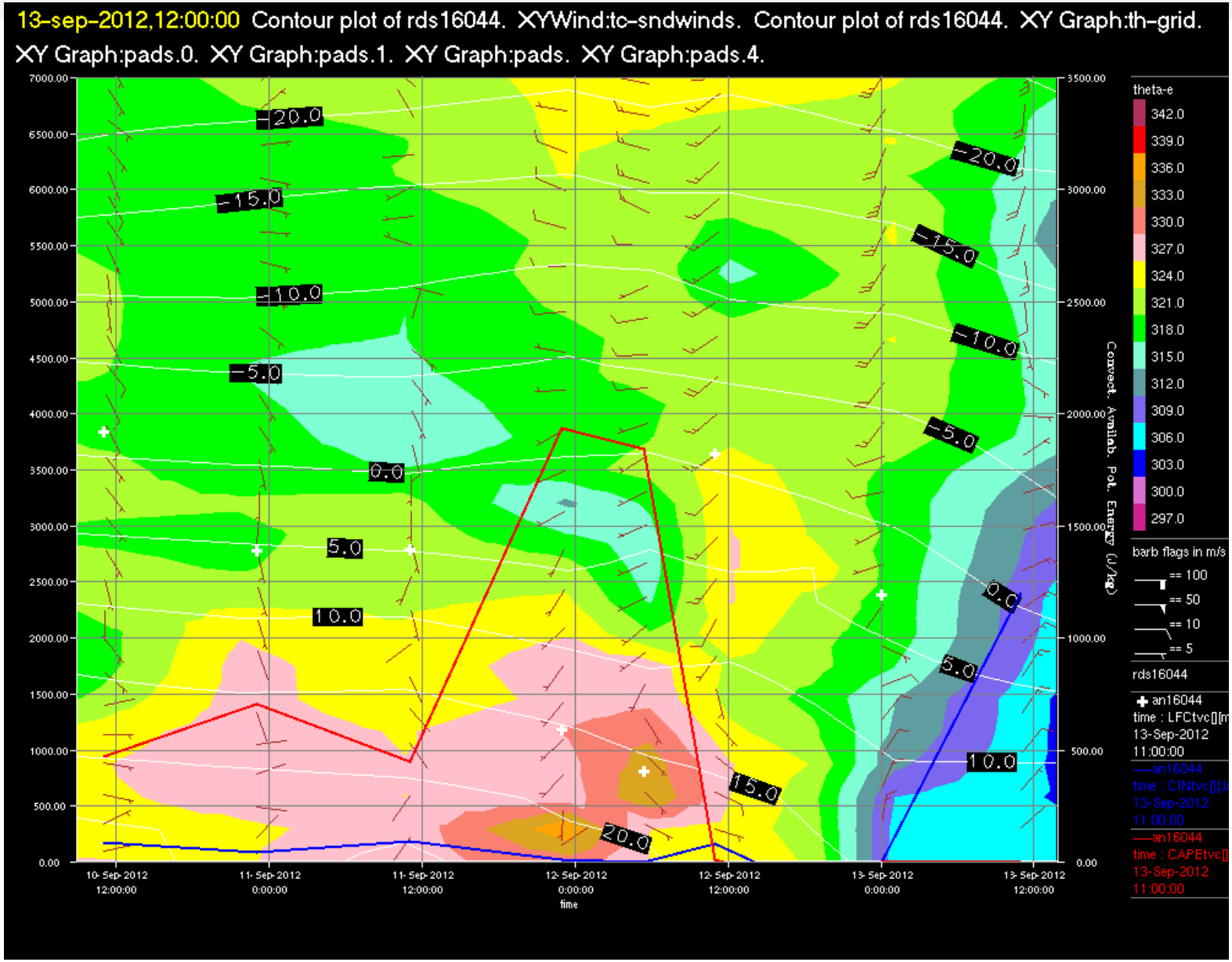
Wind gust above 17 m/s in Palazzolo at 09:10 UTC.

5' Θ_e in 4 stations of FVG plain [K]



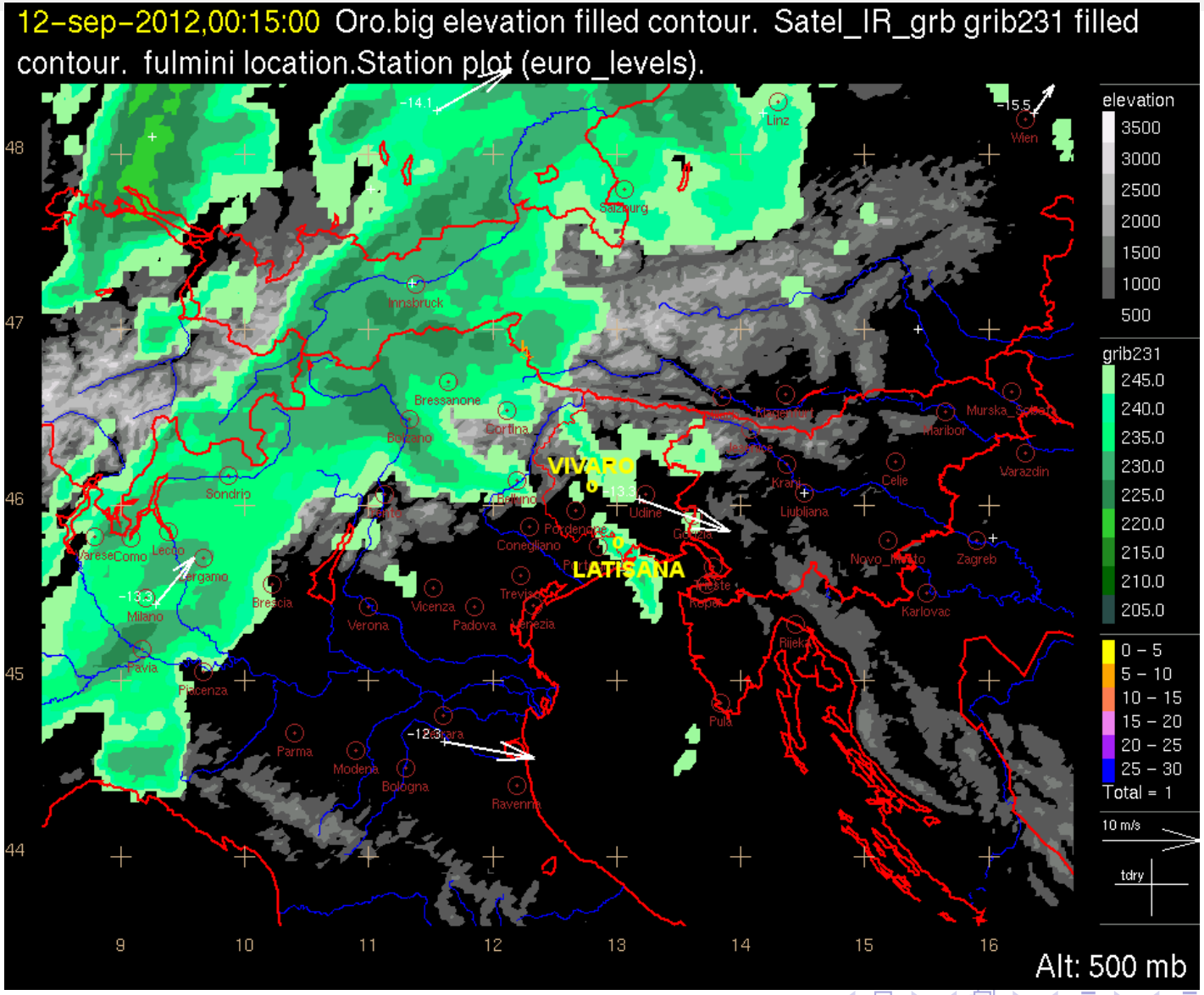
About 15 K of drop during the rainfall and another large drop during the evening after the cold front passage.

Mesoscale evolution of 6-h Udine sounding vertical profile

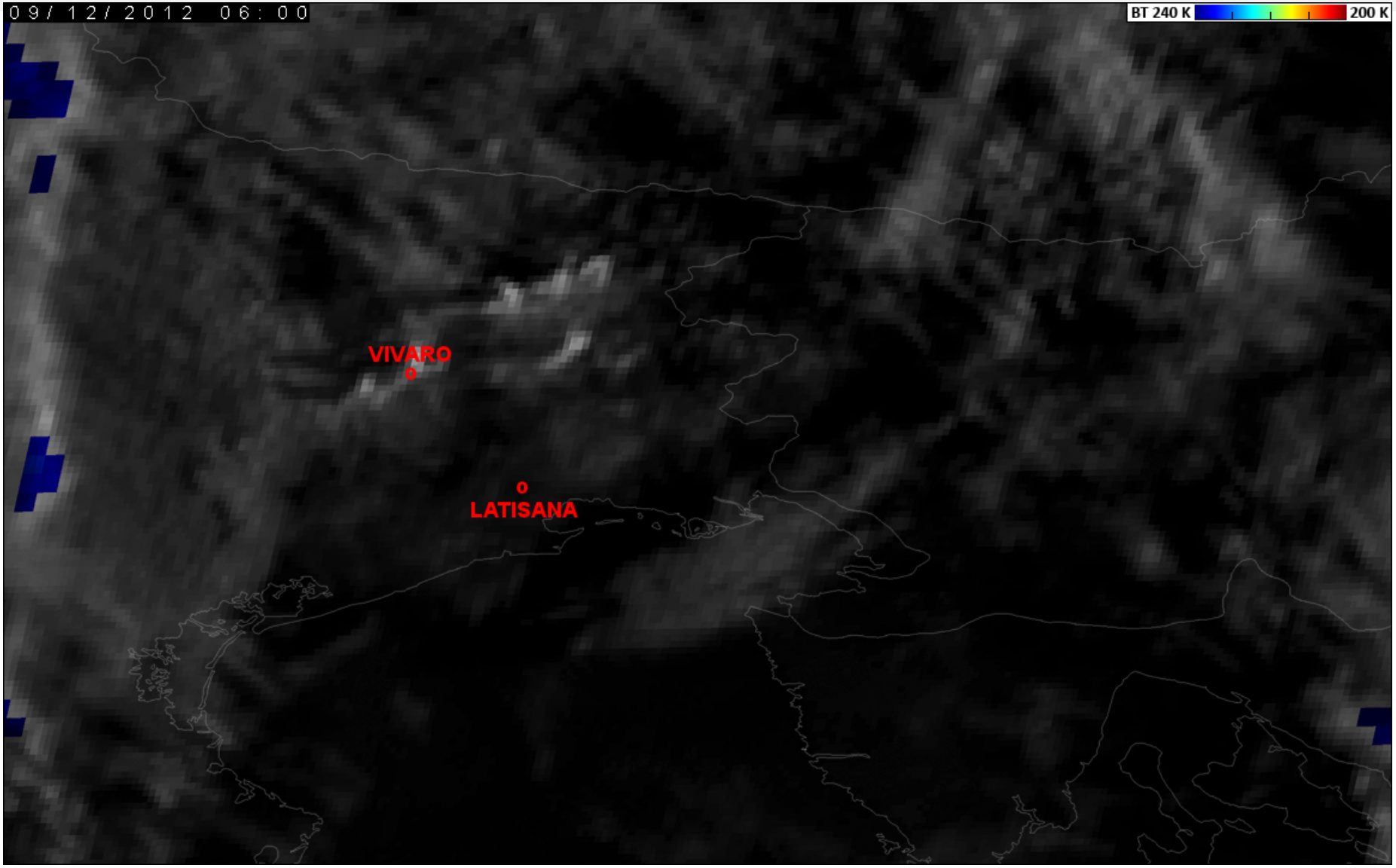


Note the abrupt change of Θ_e in the lowest 2 km during the evening of 12/09/2012 due to the cold front.

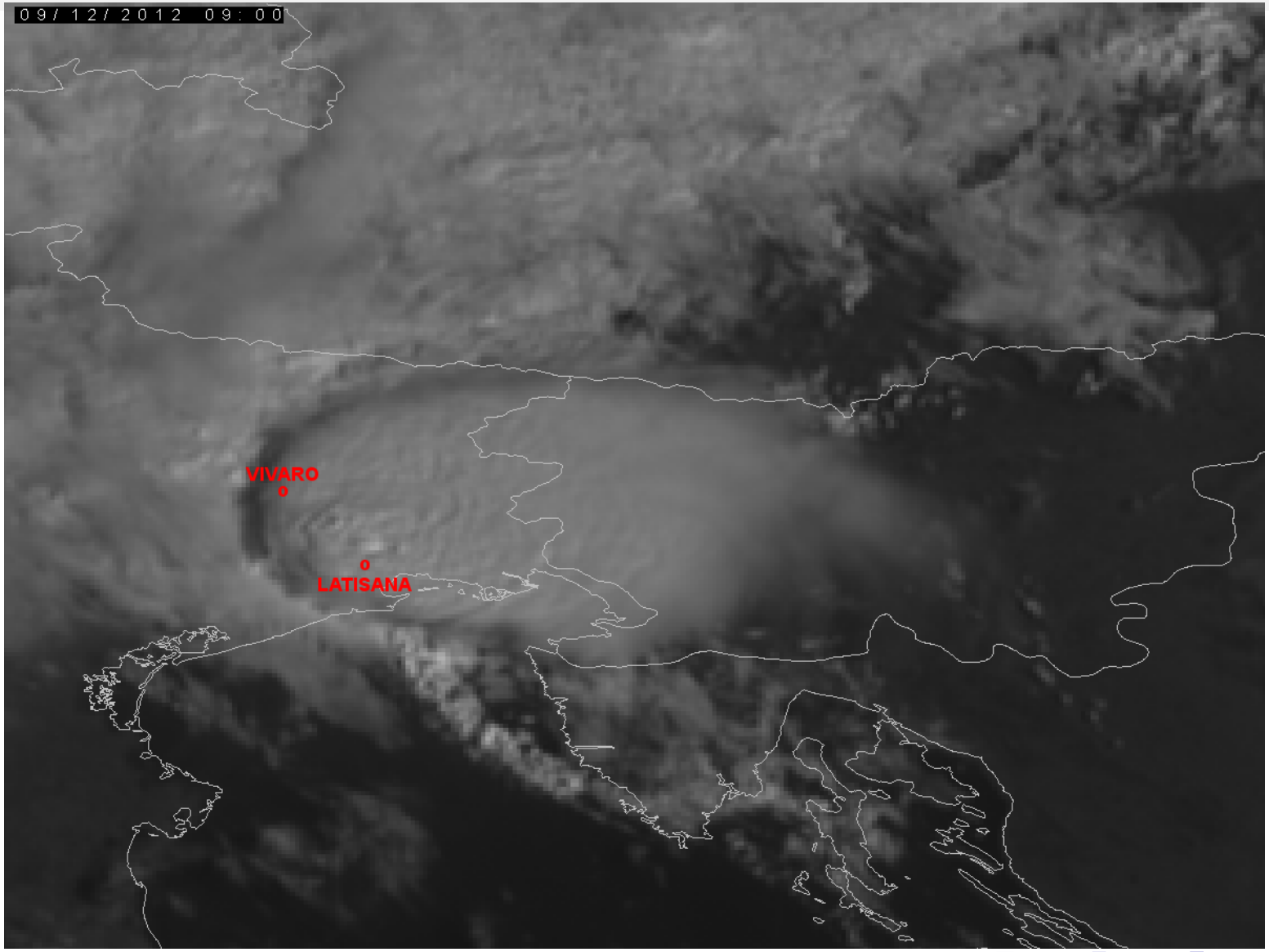
30' IR10.8um + C2G + RDS@500hPa, 0-23 UTC



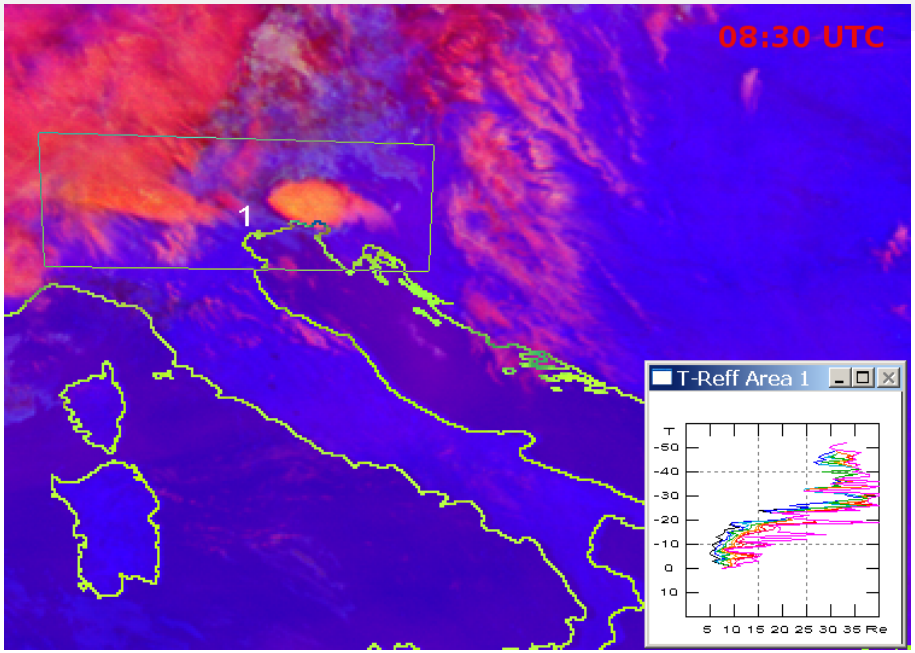
2.5' rapid scan of HRV + IR10.8um, 06:00-08:55 UTC



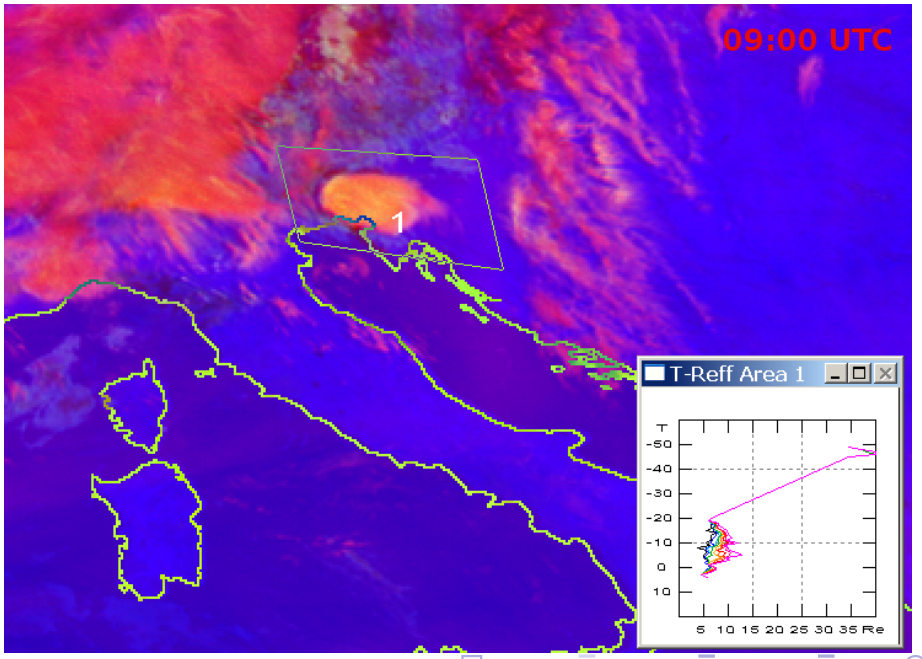
“classical” 5’ rapid scan of HRV, 09:00-11:55 UTC



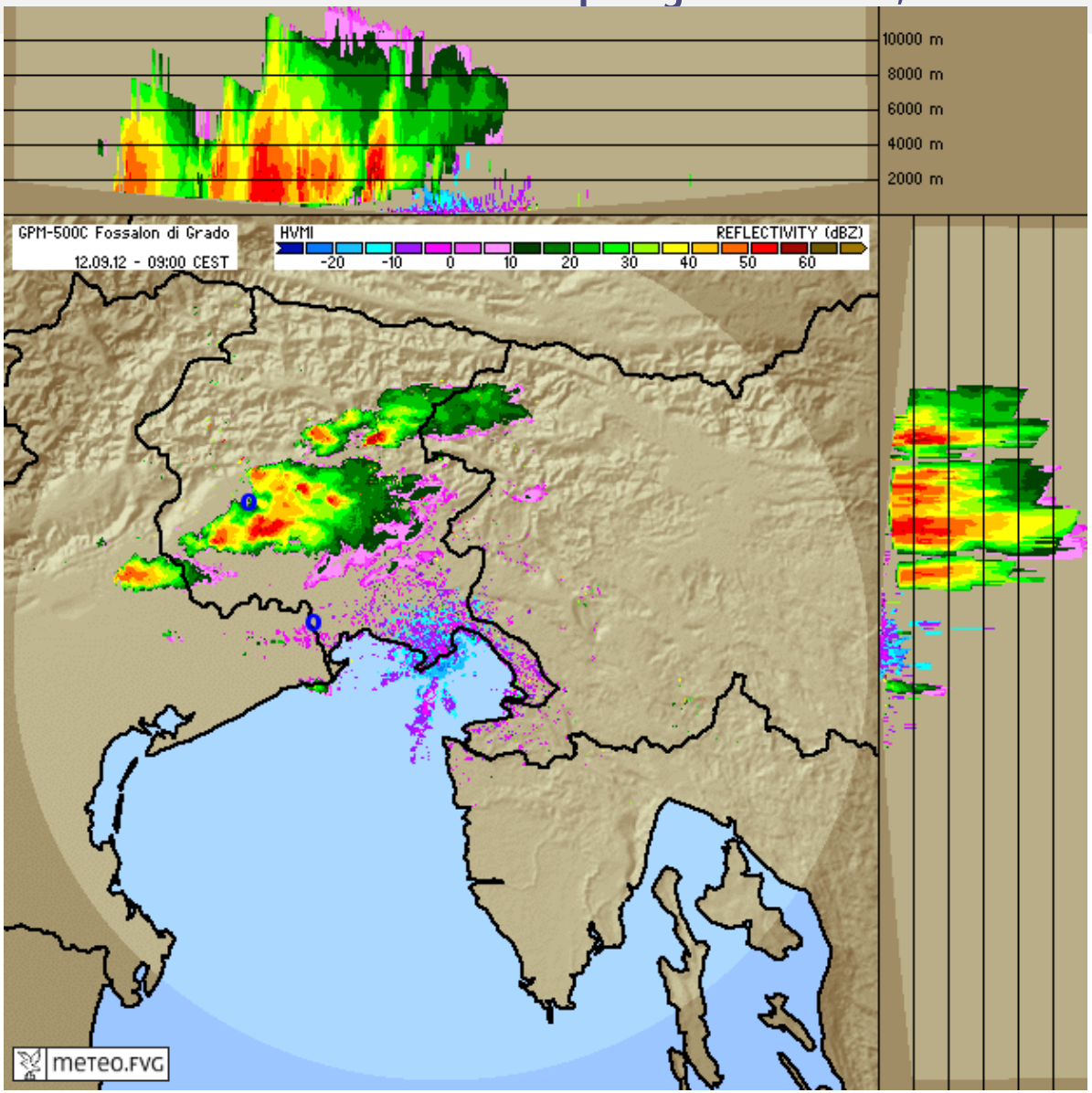
MSG_RGB "convective scale" T-R_{eff}, 08:30 & 09:00 UTC



Rosenfeld & Lensky software to estimate the effective radius R_{eff}

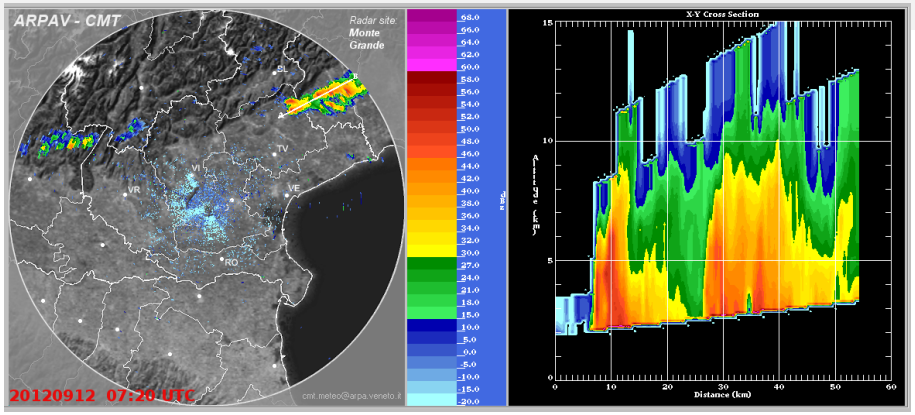


5' VMI with lateral projections, 07:00-09:55 UTC

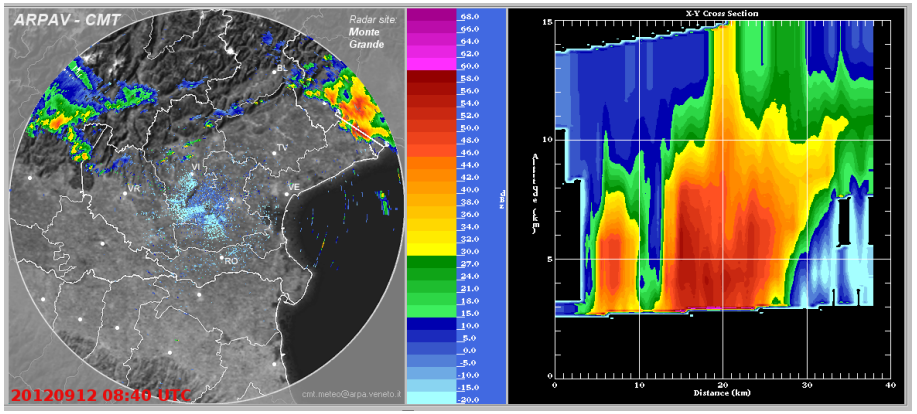


Note the "merging" of northern and southern cells between 08:20 and 08:50 UTC (CEST = UTC + 2h). At about 08:40-09:00 hail up to 3 cm was reported in the A4 highway near Latisana.

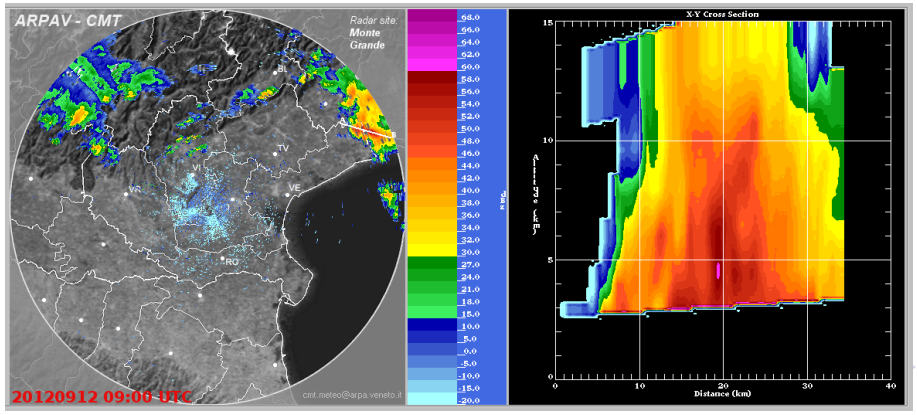
Teolo ARPAV radar PPI-cross-section, 07:20-09:00 UTC



07:20 UTC

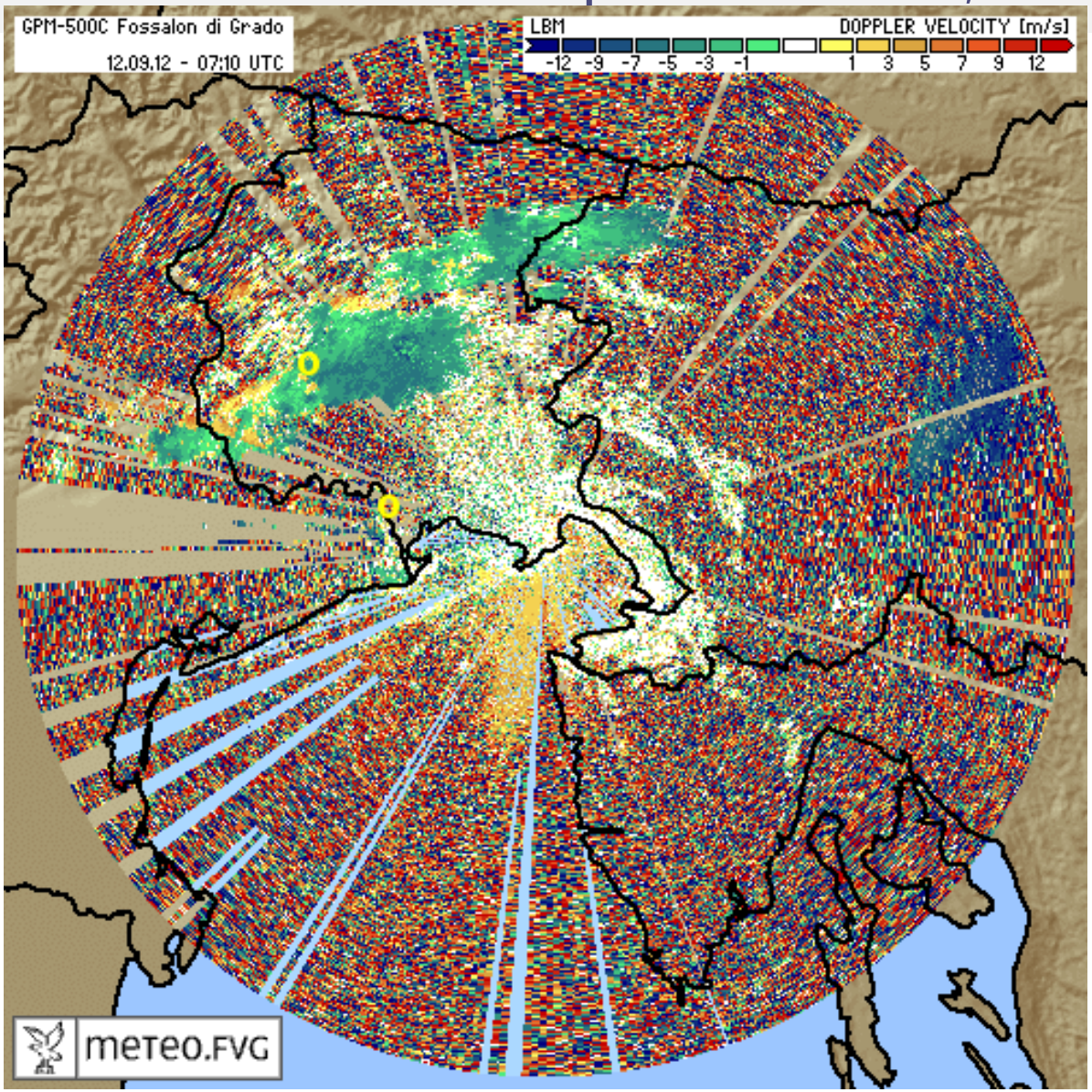


08:40 UTC



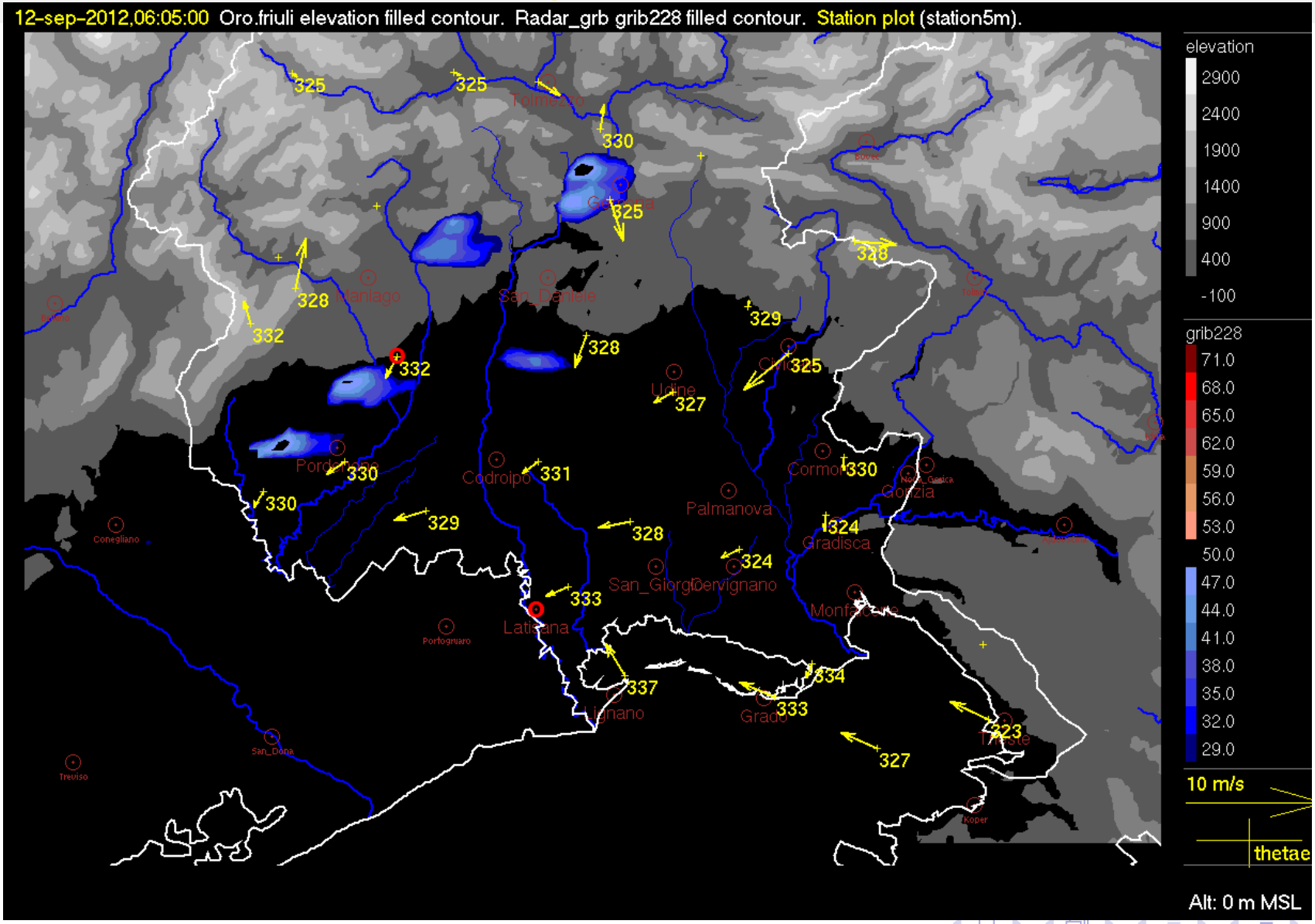
09:00 UTC

5' Lowest Beam Map DOPPLER, 07:10-09:55 UTC

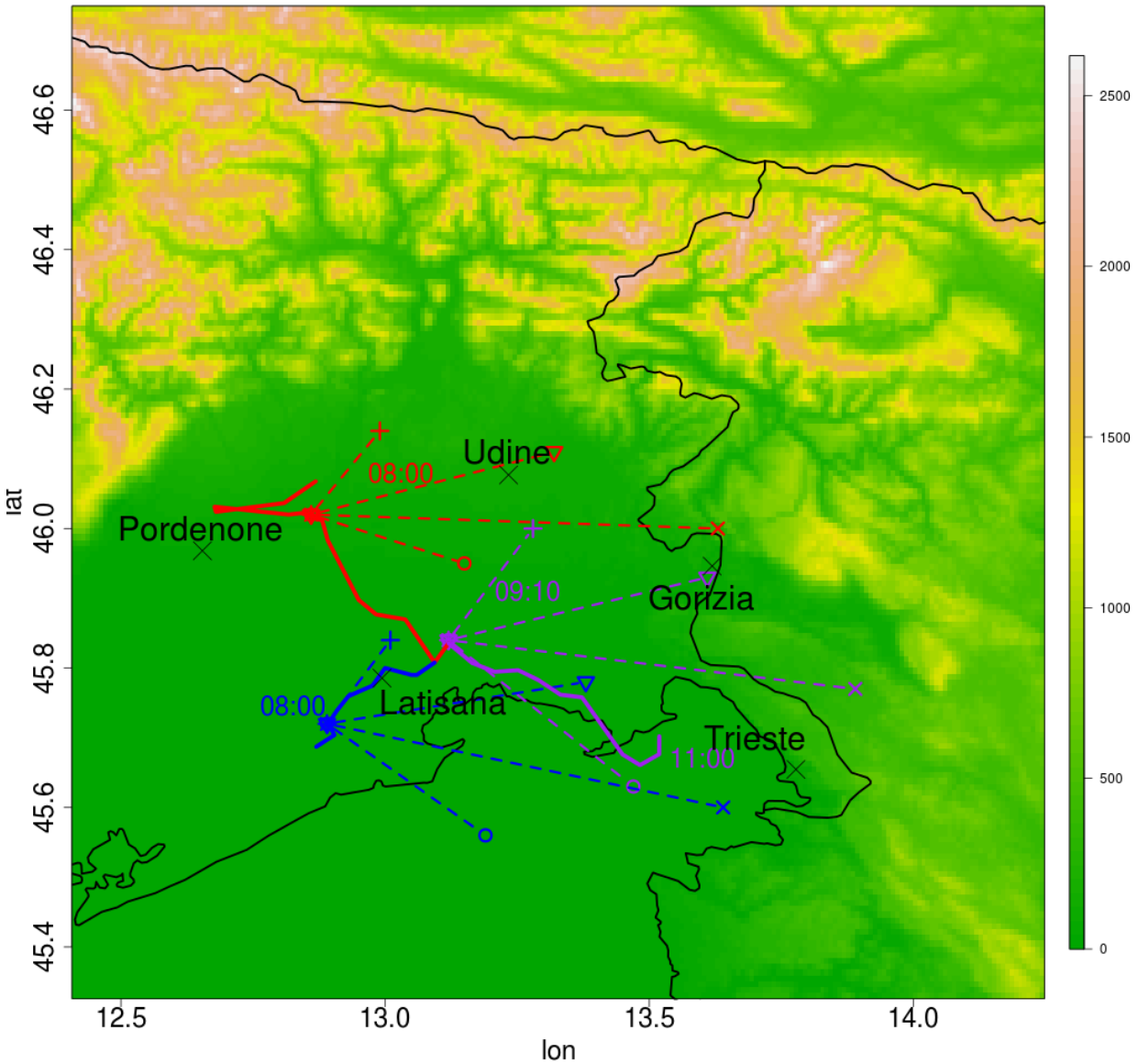


There seems to be a mesocyclone signature (possibly associated with a supercell) between 07:55 and 09:10 UTC (CEST = UTC + 2h).

10' radar VMI + 5' Θ_e & wind +C2G, 06:00-09:50 UTC



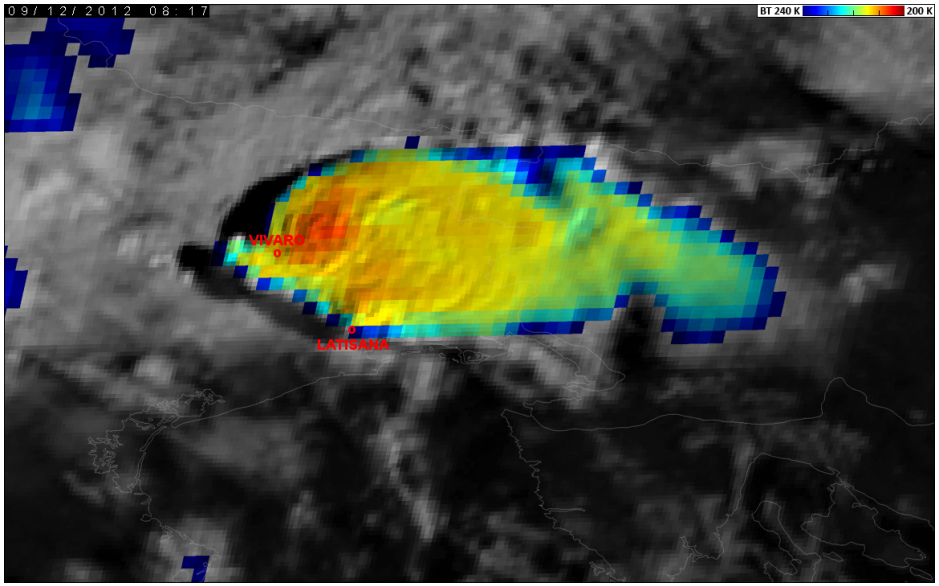
VMI centroid trajectories + WRF wind & "Corfidi vectors"

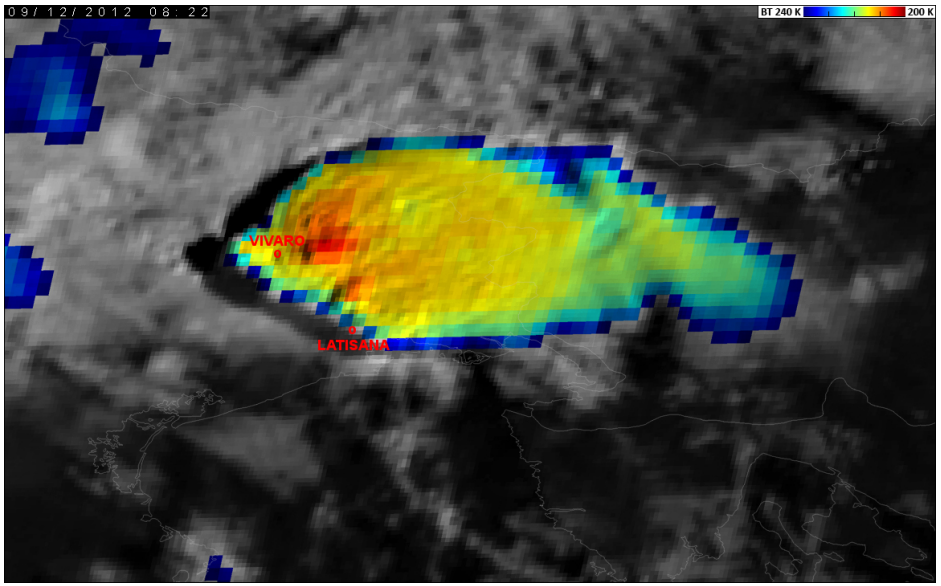


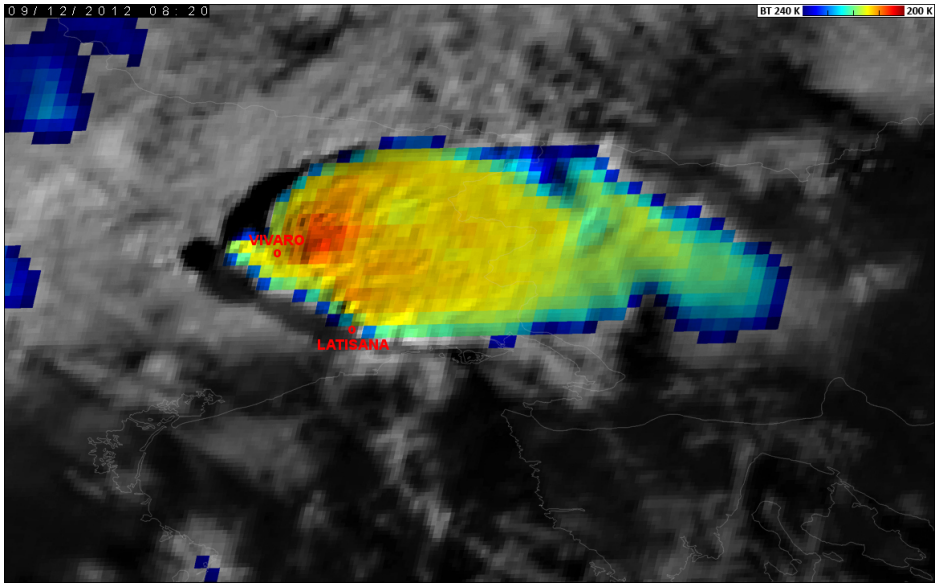
Note the abrupt change in the trajectory of the northern storm at about 8 and 9 UTC. In that period a supercell was very likely. Possibly, the southern storm cut the southerly warm inflow from the Adriatic feeding the northern storm (confirmed by high-res model simulations).

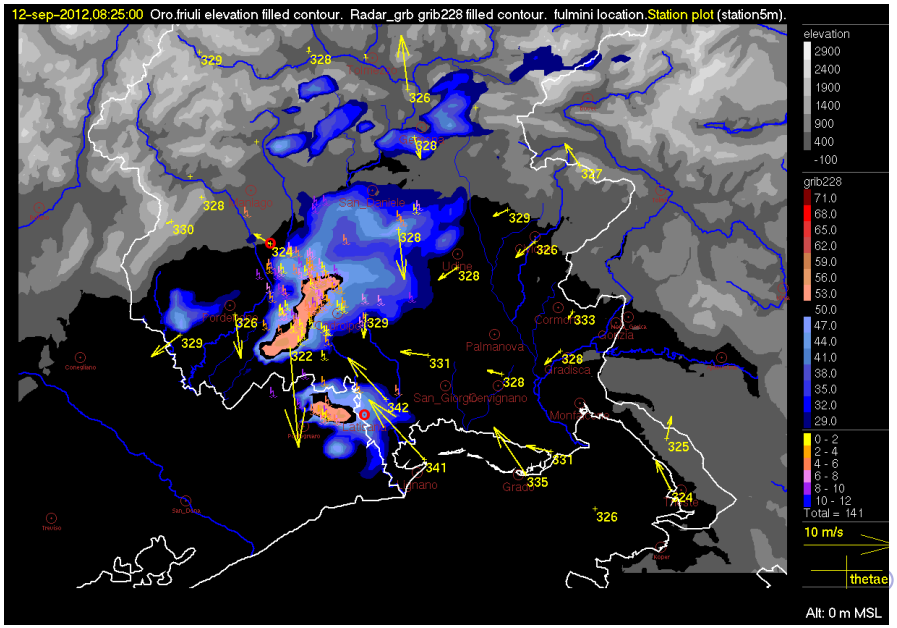
- ∇ 850–300 hPa wind,
- + sfc–3 km wind
- o "Corfidi upwind".

08:20 UTC ±2.5' comparison (MSG not parallax corrected)

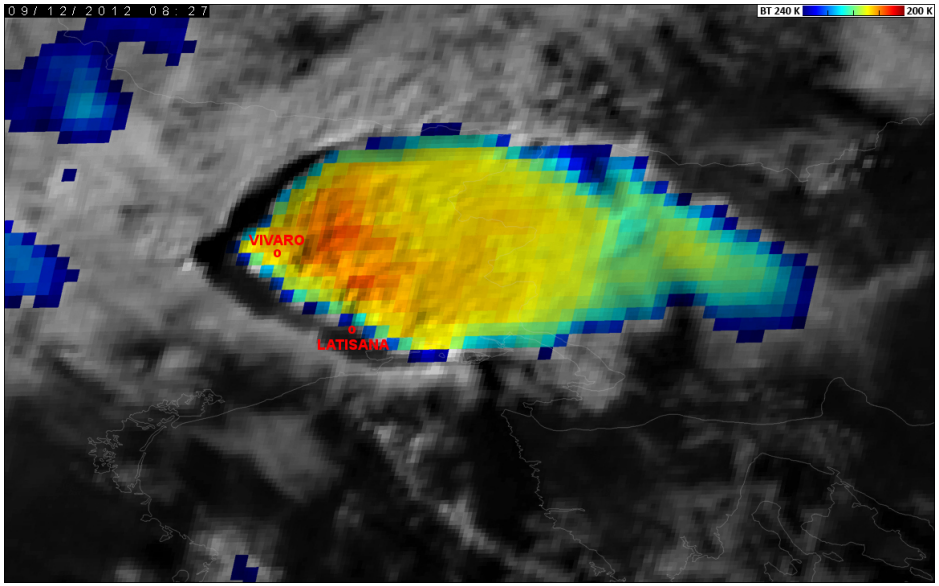


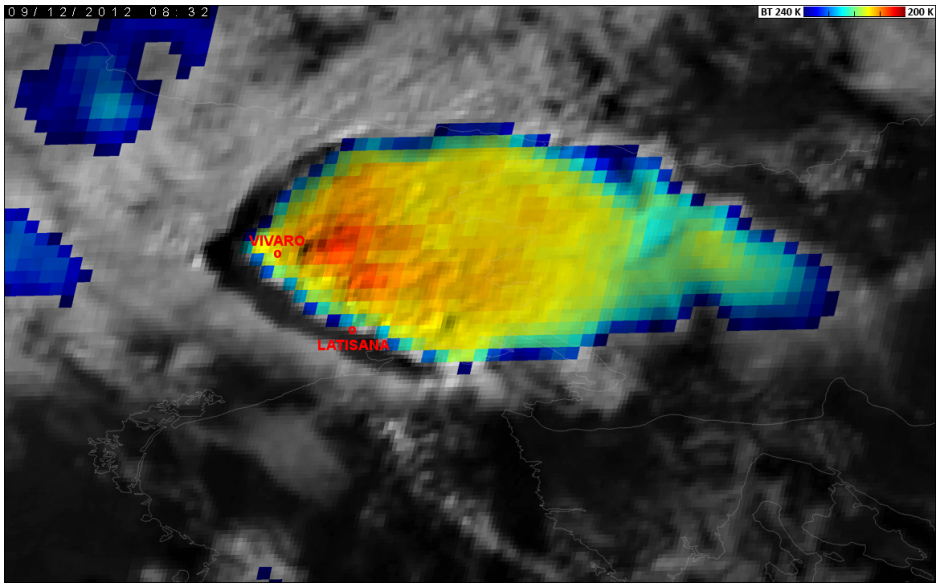


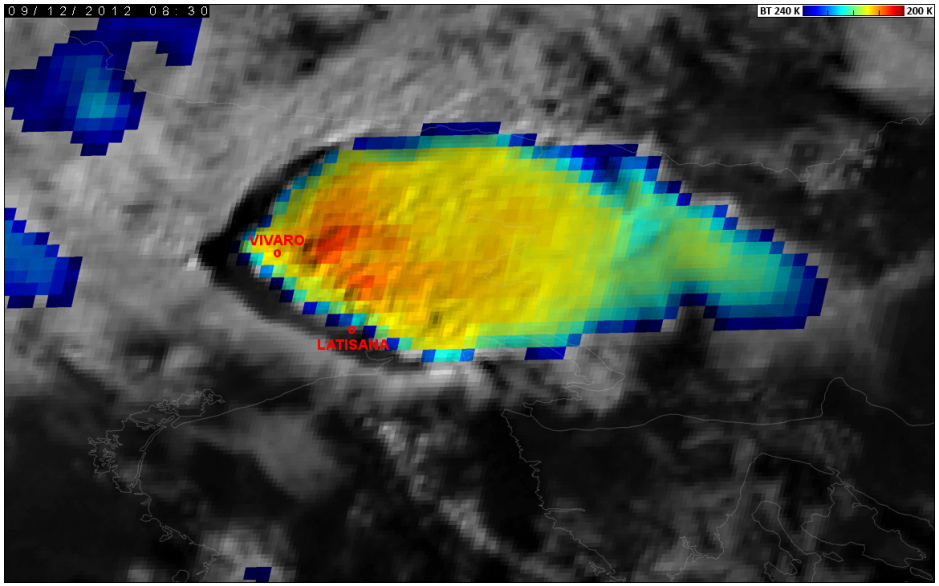


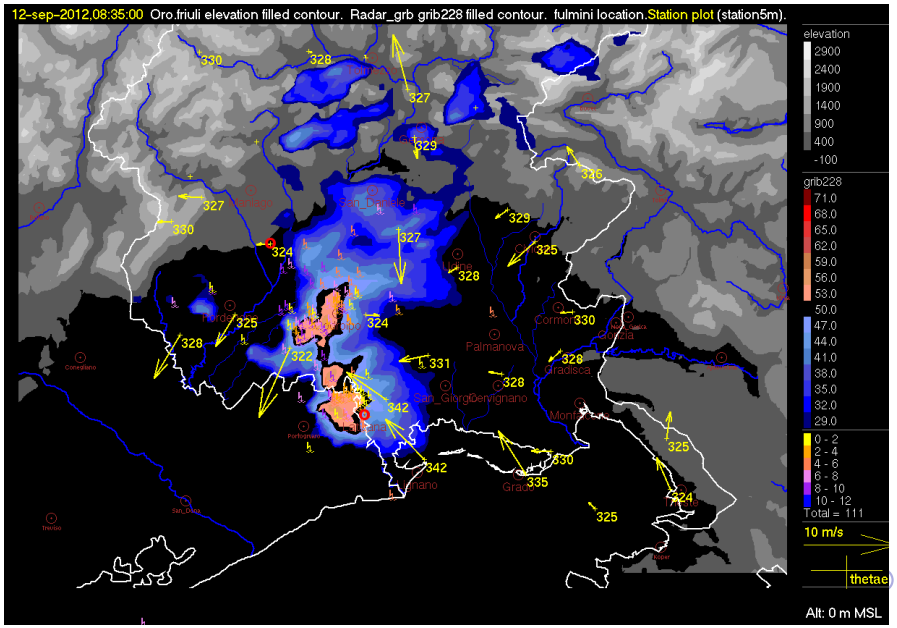


08:30 UTC ±2.5' comparison (MSG not parallax corrected)

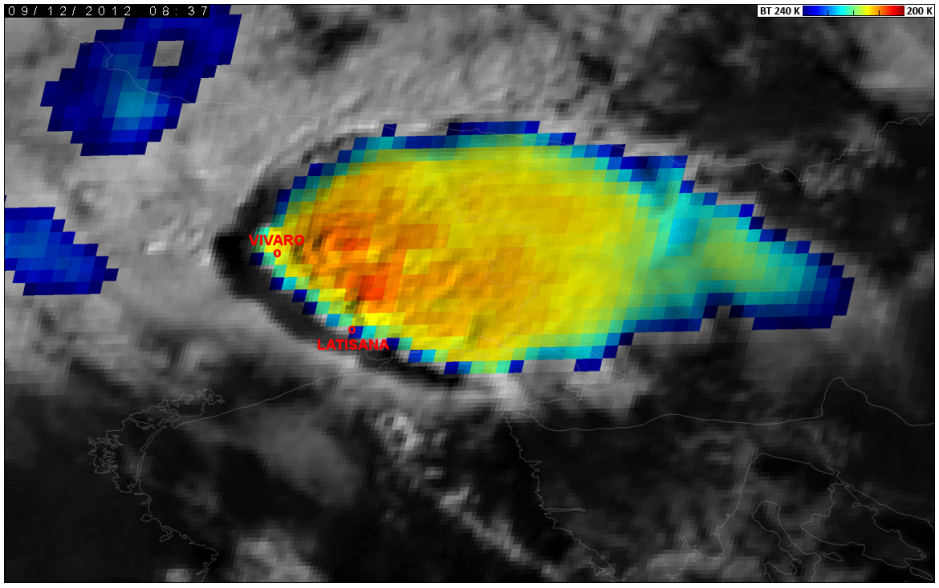


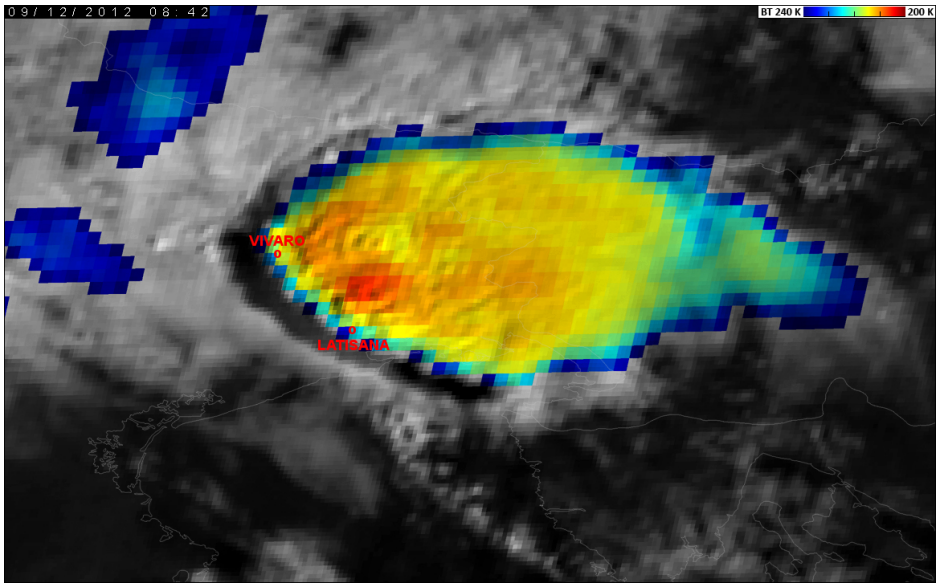


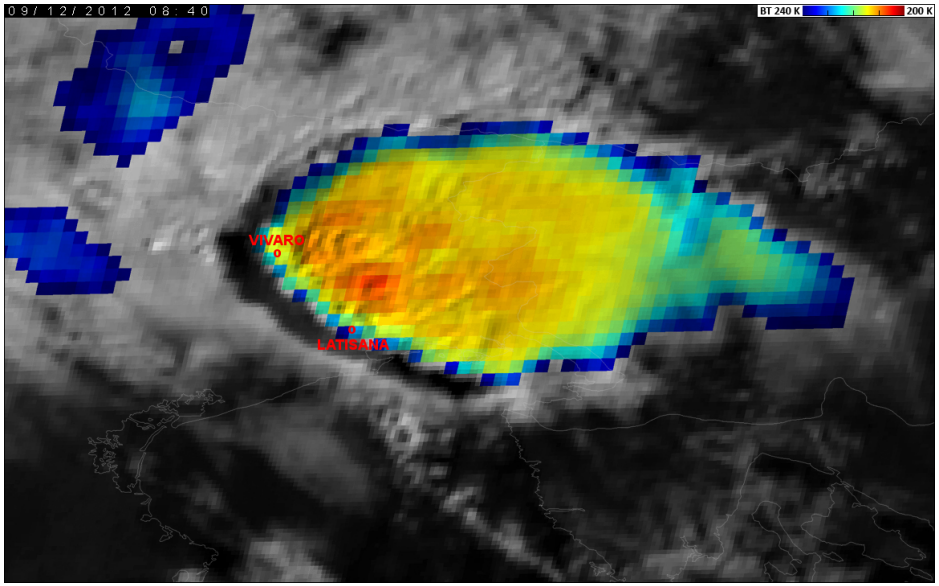


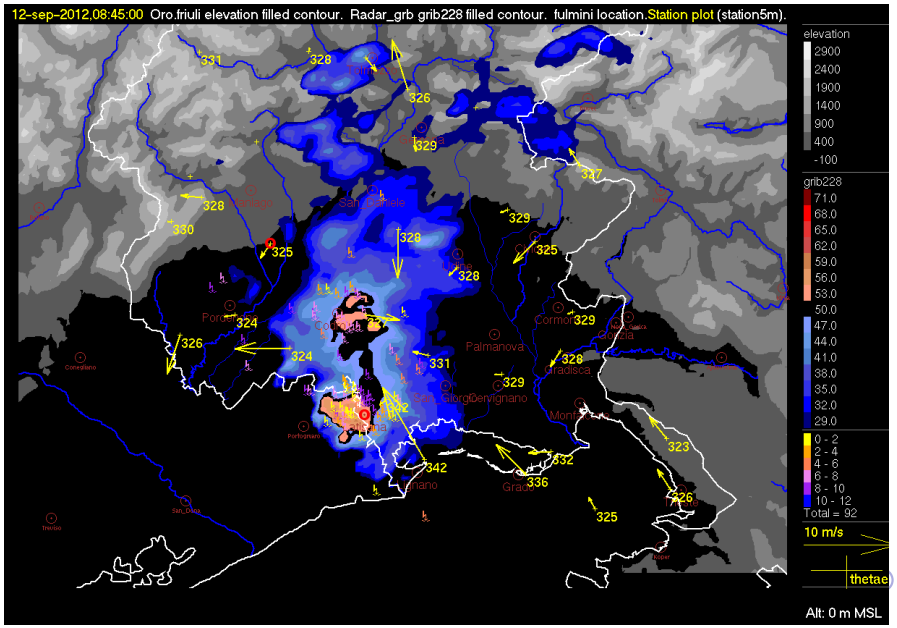


08:40 UTC ±2.5' comparison (MSG not parallax corrected)

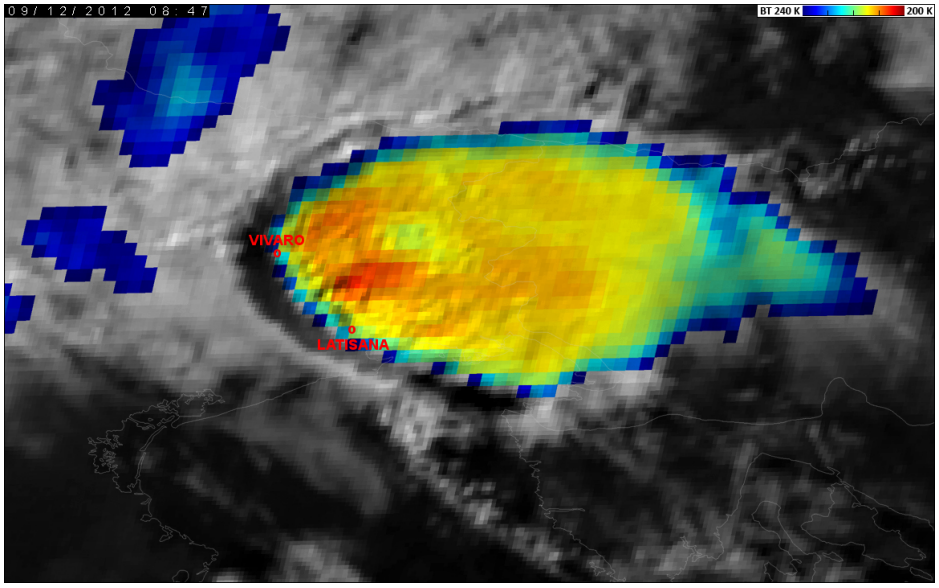


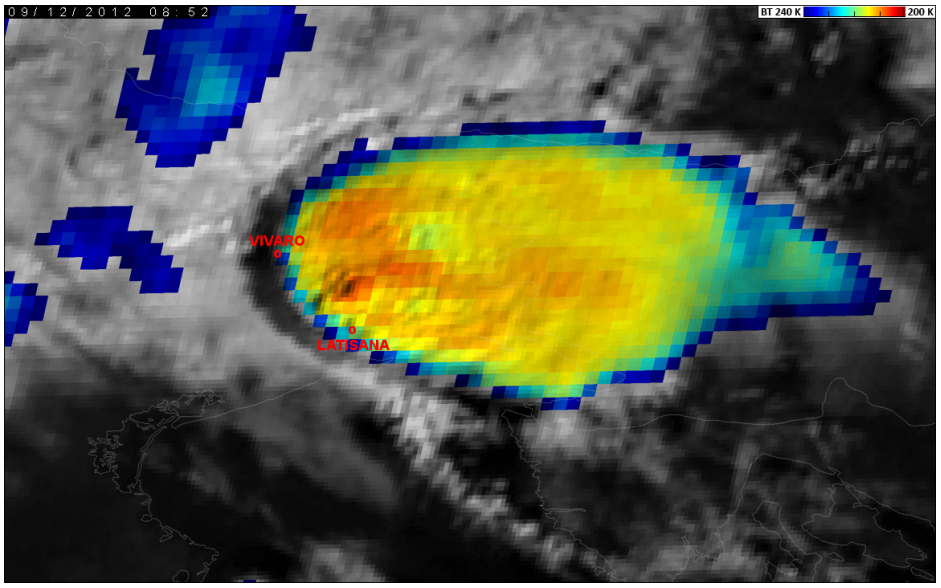


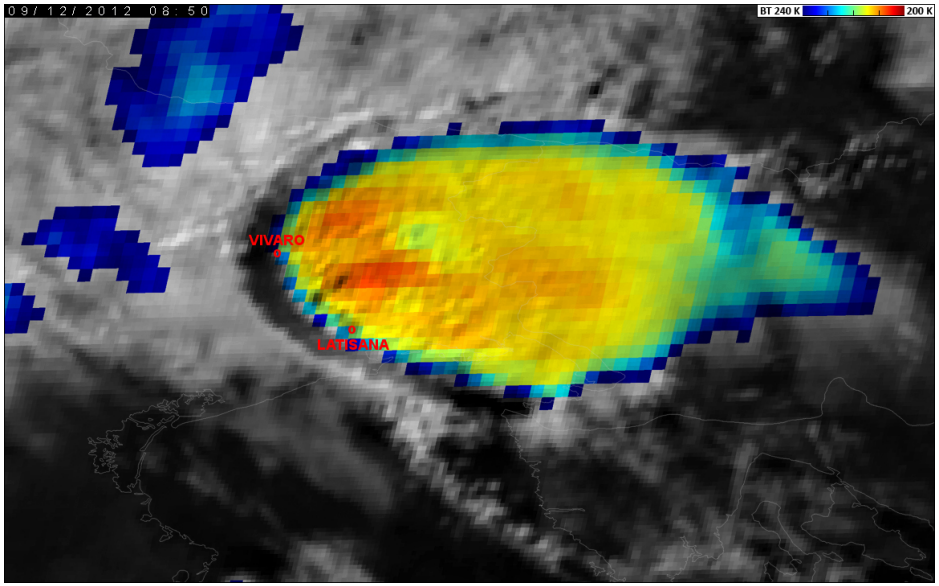


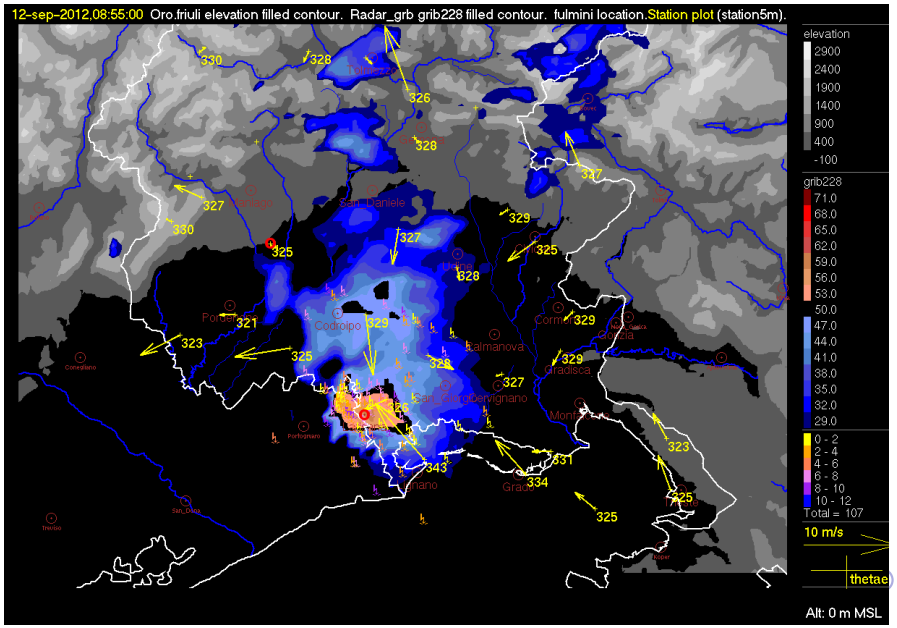


08:50 UTC ±2.5' comparison (MSG not parallax corrected)









Comparison summary

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4. The switch in "strength" between the northern and southern storms is well captured by the 2.5' rapid scan. The beginning of this shift is seen at 08:30–08:32 UTC and the end is seen at 08:38–08:40 UTC.

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5. The minimum temperature (red, brown colors) and the rings around Overshooting Tops is well correlated with maximum radar VMI and with the presence of hail at ground.

Conclusions:

1. During 12 September 2012 several severe weather episodes hit NE Italy and Istria. In particular during the morning two interesting storms developed over the FVG plain. The northern storm moved from North-West to South-Est between 07:55 and 09:10 UTC, with a trajectory diverging from the –simulated– mean wind (about 80° on the right) and from the "Corfidi vectors" (originally developed for MCS) and showing a mesocyclone signature.

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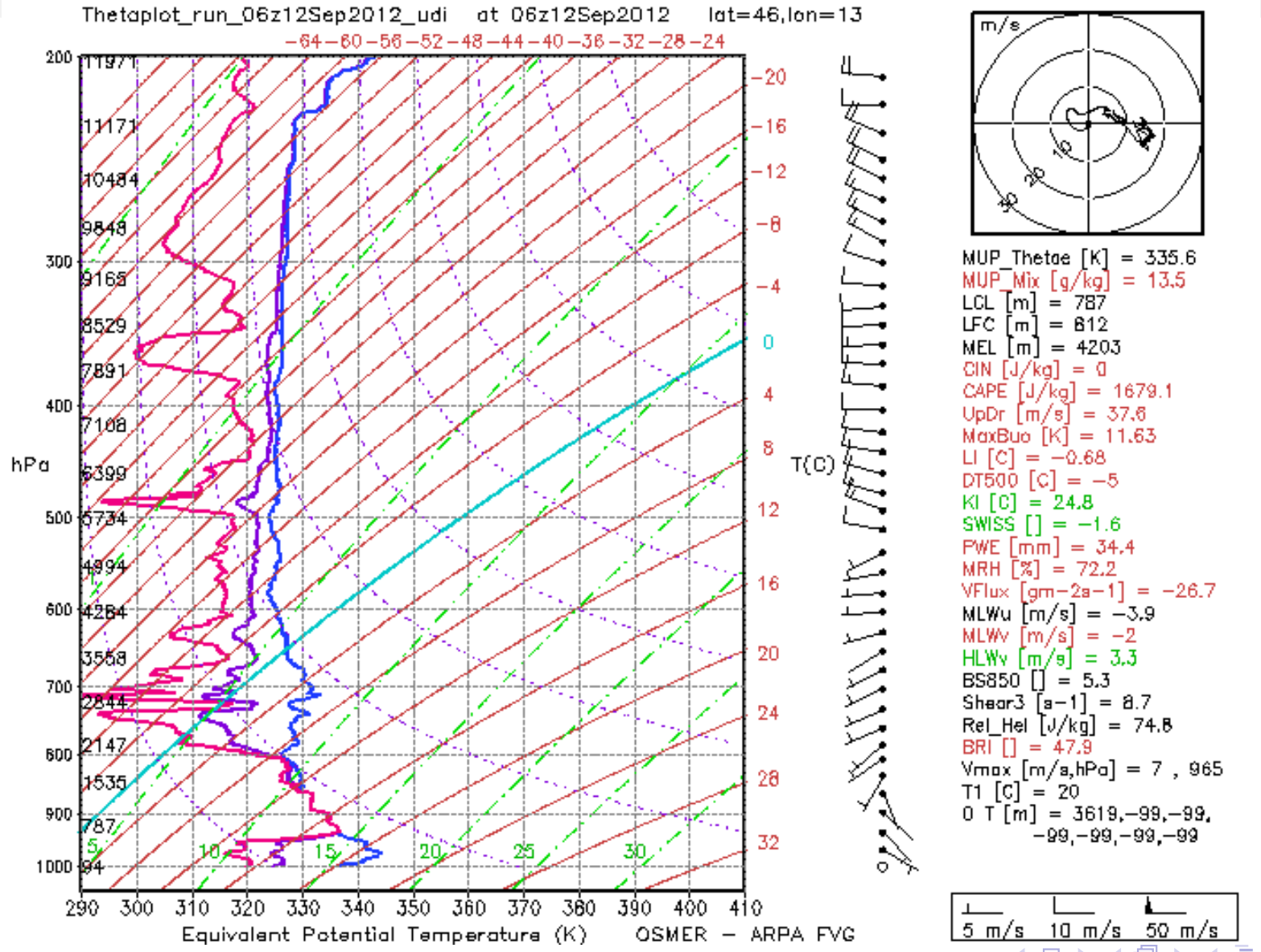
3. The southern storm was able to stop the supercell and to deflect its trajectory (more easterly), probably cutting the low-level inflow of moist air coming from the Adriatic Sea.
4. The 2.5' rapid scan available up to 08:55 UTC documented in details the interaction between the two cells during the "merging" phase (08:20-08:50 UTC).

Thanks! For info: *agostino.manzato@meteo.fvg.it*

References

1. Corfidi, S. F., 1998: Forecasting MCS Mode and Motion. *Preprints 19th Conference Severe Local Storms*, Minneapolis, MN.
2. Kerkmann, Setvák and Manzato 2012 *"Experimental 2.5-minute super rapid scans from MSG-3 capture a supercell storm above northern Italy (12 September 2012)"* available at: http://oiswww.eumetsat.org/WEBOPS/iotm/iotm/20120912_convection/20120912_convection.html
3. Manzato, A., Davolio, S., Miglietta, M., Pucillo, A. and M. Setvák, 2014: *12 September 2012: A supercell outbreak in NE Italy?*, submitted to Atmos. Res..
4. Meteo.fvg September 2012: *L'evento del mese: i temporali del 12 settembre*, available online at http://www.osmer.fvg.it/IT/METEOFVG/StrutturaMeteoMensile.php
5. Setvák, M., Charvát, Z., Valachová, M., Bedka, K., 2012: *Blended "sandwich" image products in nowcasting*, Proc. 2012 EUMETSAT Meteorological Satellite Conference, Sopot, Poland. EUMETSAT P.61.

Appendix: 06 UTC Udine Thetaplot & indices



Thetaplot (Morgan 1992) at 06 UTC shows potential instability above Udine.