MARTIN SETVÁK setvak@chmi.cz

CZECH HYDROMETEOROLOGICAL INSTITUTE
ČESKÝ HYDROMETEOROLOGICKÝ ÚSTAV

JOHANNES MÜLLER Johannes.Mueller@eumetsat.int

EUMETSAT

The 2.5-minute Meteosat-10 rapid scan experiment and storm-top observations

ECSS2013 Conference, 3 – 7 June 2007, Helsinki, Finland

Introduction

- The 2.5 minute super rapid scan experiment was proposed by the EUMETSAT/ESSL Convection Working Group at the 32nd STG-SWG meeting (13-14 March 2012) and approved/recommended by the meeting.

- Motivation for this proposal:

  - open questions related to storm-top features variability in time, e.g. lifetime of overshooting tops (OT), their brightness temperature, …

  - possible impacts of the satellite sampling frequency on detection of various features (such as OTs)

  - preparations for the Meteosat Third Generation (MTG), which will use this sampling frequency (2.5 minutes) operationally within its "Regional Rapid Scan" (RRS) service.

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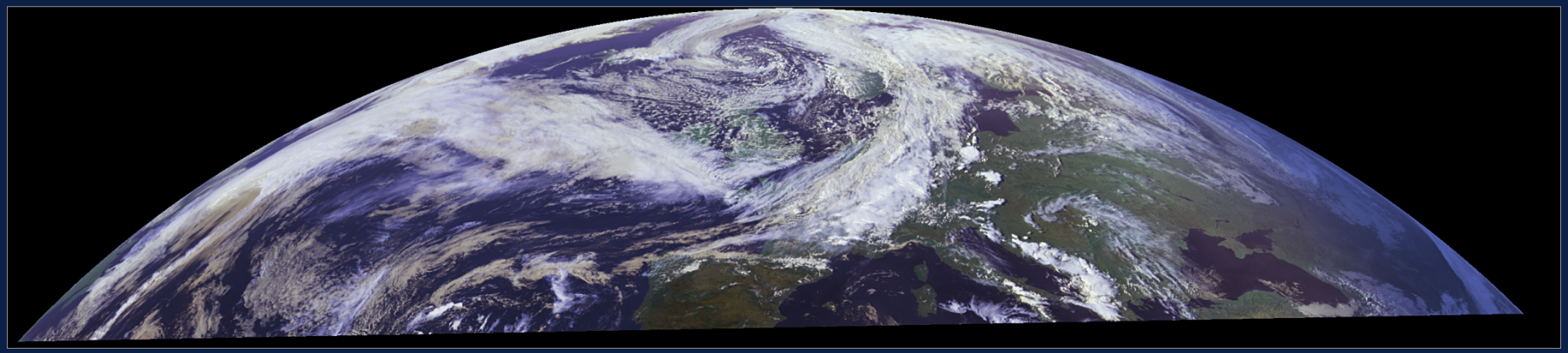
  - preparations for the Meteosat Third Generation (MTG), which will use this sampling frequency (2.5 minutes) operationally within its "Regional Rapid Scan" (RRS) service.

- The test itself was carried out on 11–12 September 2012 with the MSG-3 satellite (later renamed to Meteosat-10) during its commissioning.

- The 2.5 minute scanning started on 11 September 2012 at 09:00 UTC, and lasted for 24 hours.

11 September 2012, 09:00 UTC – start of the test (EUMETSAT MSG control room)

Geographical coverage (MSG-3, 11 September 2012, 15:00 UTC)



- The data covered by the test consists of approximately 1800 image lines for the HRV band, and about 600 image lines for the 11 remaining SEVIRI bands, covering the northernmost part of the globe.

- Due to the technical reasons, no on-board data calibration was performed during the test; however this has no impact on subjective interpretation of the images, and on image-to-image quantitative changes between these (e.g. relative changes of the cloud-top BT minima).

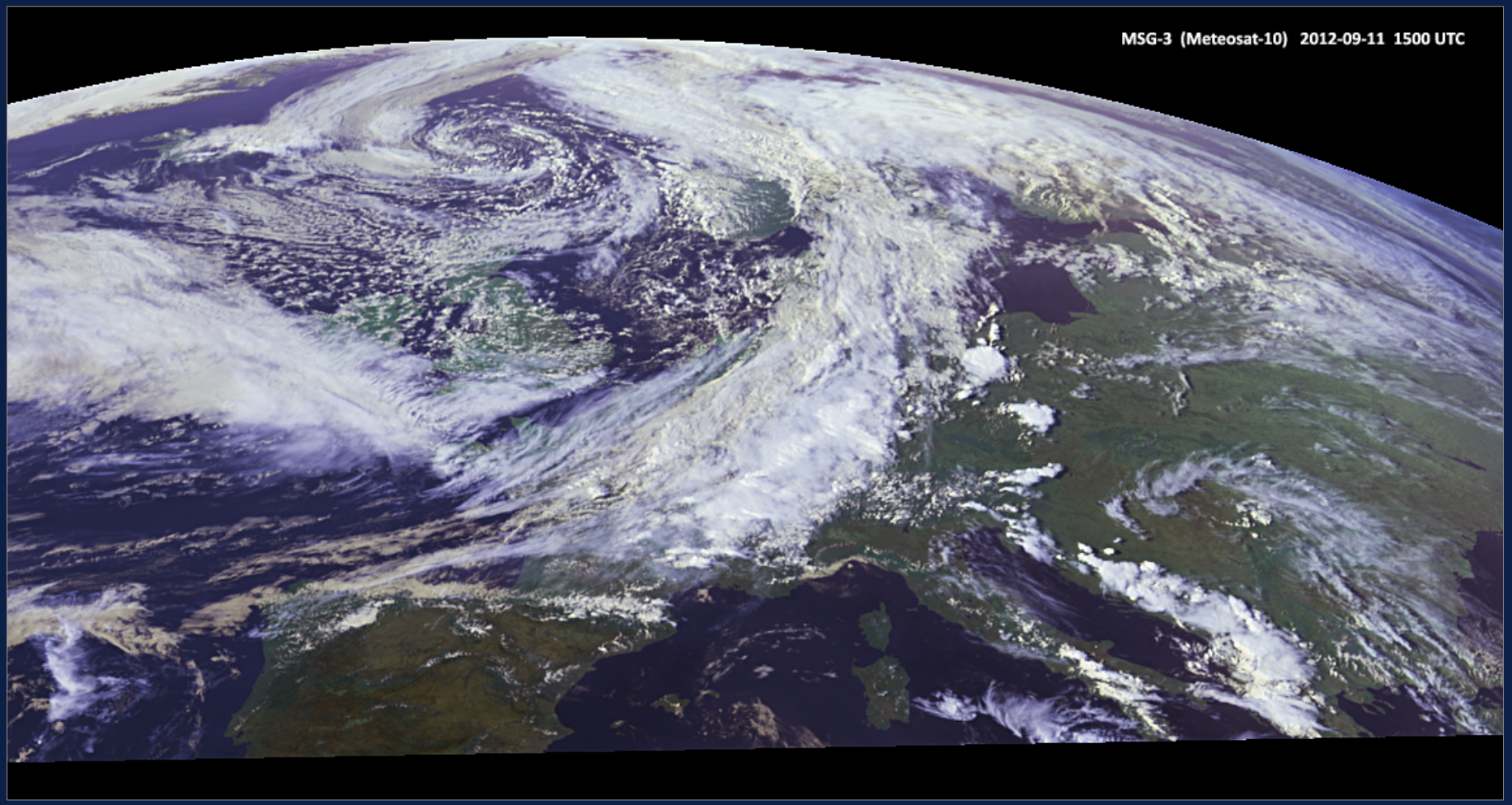
- For overview of the general weather situation and data collected within the test see the following movies:

  RGB (VIS0.6, VIS0.8 and IR10.8) – MOV or MP4

- All data collected during the test is available for download at:

  ftp.eumetsat.int/pub/EUM/out/OPS/User/2.5_min_scan_test_files/

Geographical coverage and weather situation



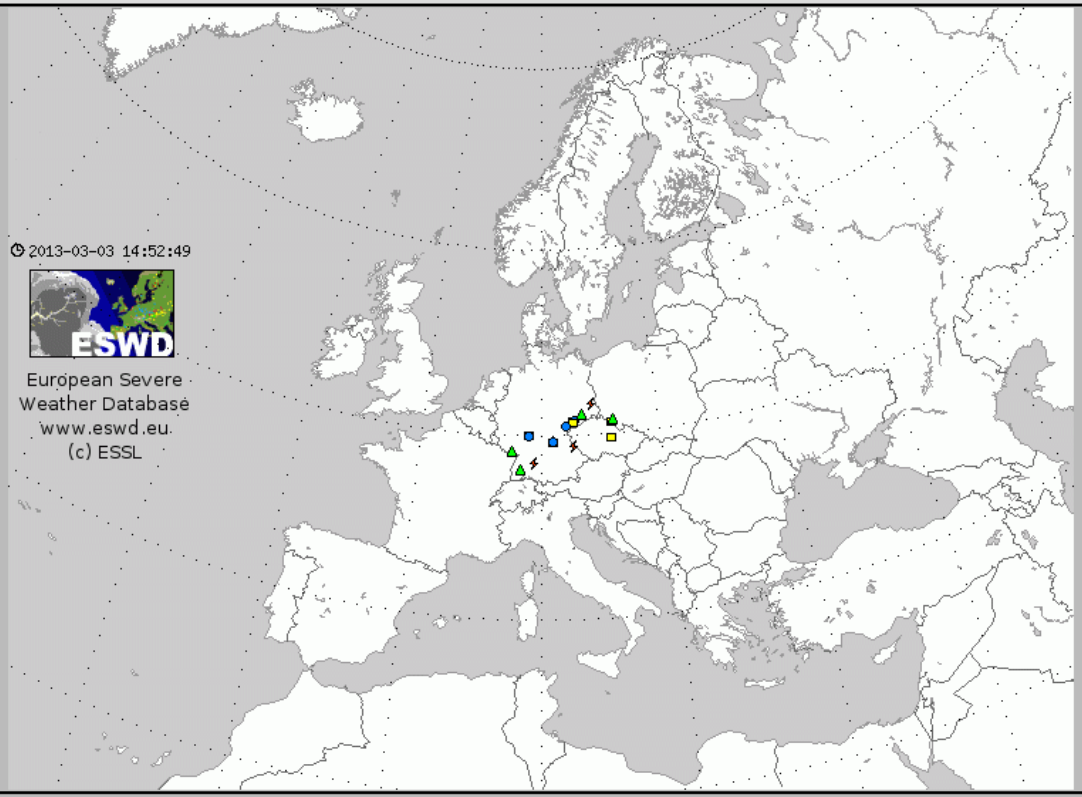
On the first day, 11 September 2012, several regions of deep convective activity developed ahead of a cold front, which was passing across western and central Europe, or were embedded within the front itself. Besides this pre/frontal convection, other extensive deep convection formed over the Balkan Peninsula (along its Adriatic coast) and southern Italy. Early morning of the second day (12 September 2012), large storms formed in north Italy.

Significant weather (European Severe Weather Database, ESWD)

Selected data from the database

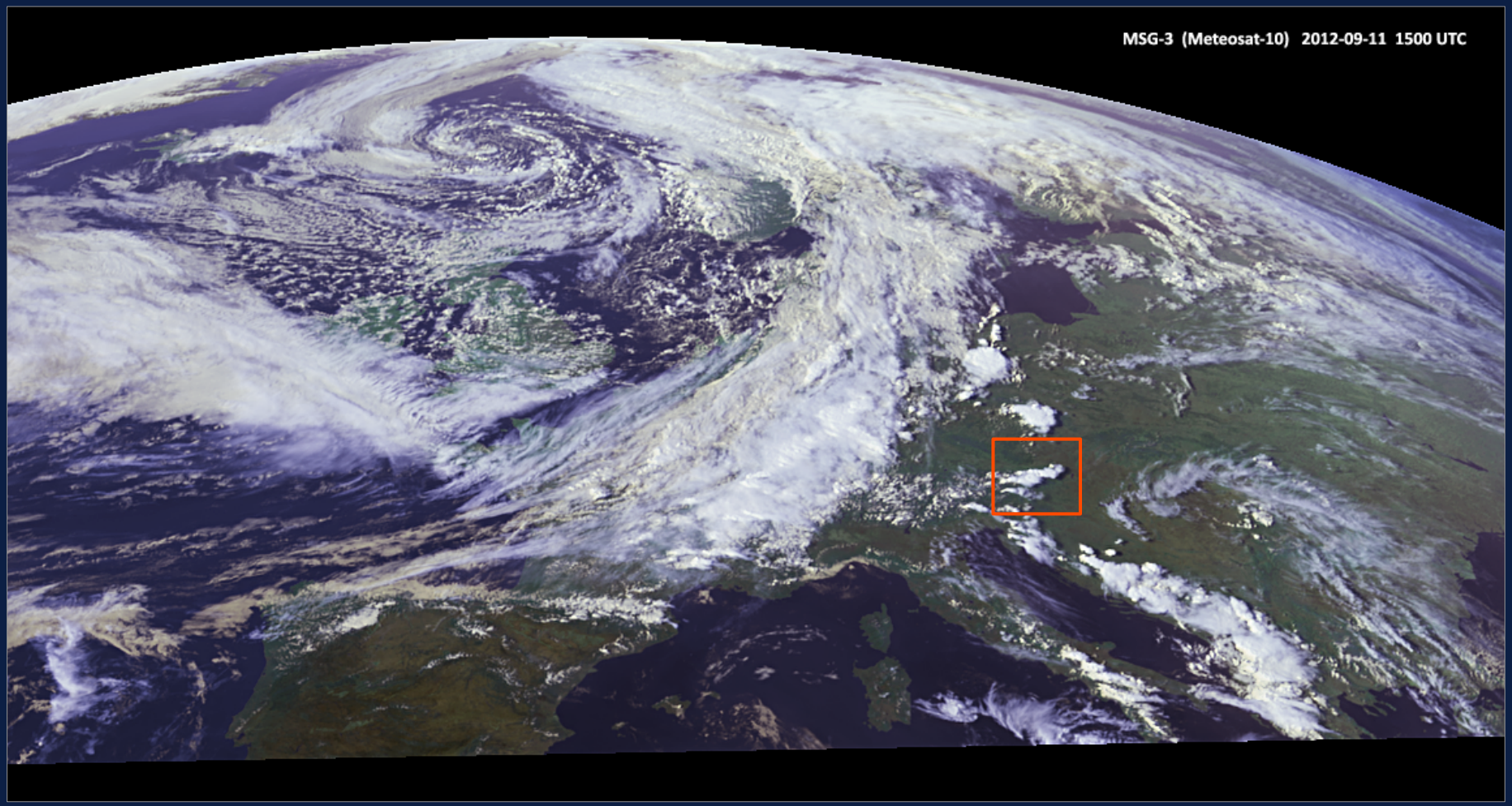
selected: all reports - funnel clouds, gustnadoes, large hail, heavy rain, tornadoes, severe wind gusts, damaging lightning strikes
- occurring between 11-09-2012 09:00:00 and 12-09-2012 09:00:00 GMT/UTC

number of selected reports: 17



http://www.essl.org/ESWD/

Storms over Austria, 11 September 2012

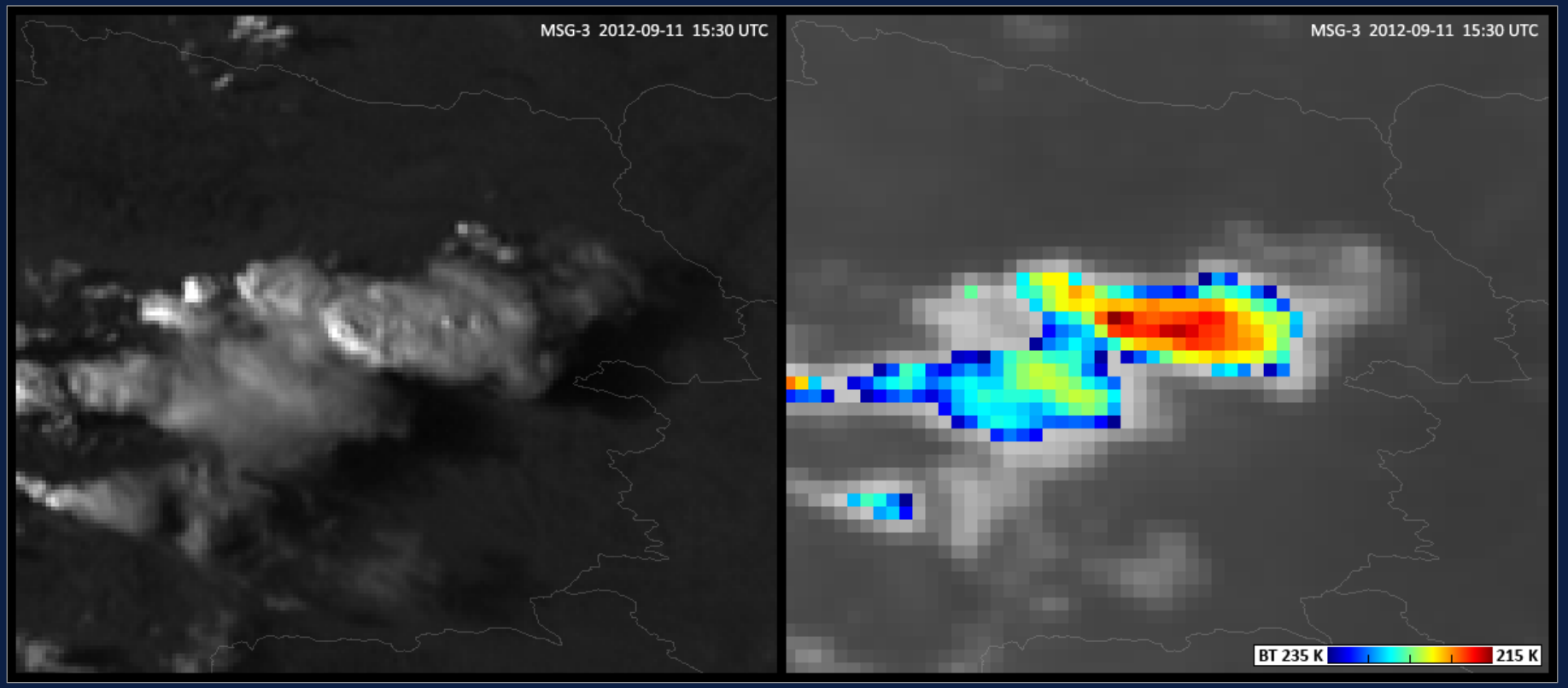


A series of images documenting the high temporal variability of overshooting tops, observed in the MSG-3 experimental 2.5-minute rapid scan data above Austria.

The red rectangle outlines the area, which is shown next in detail ...

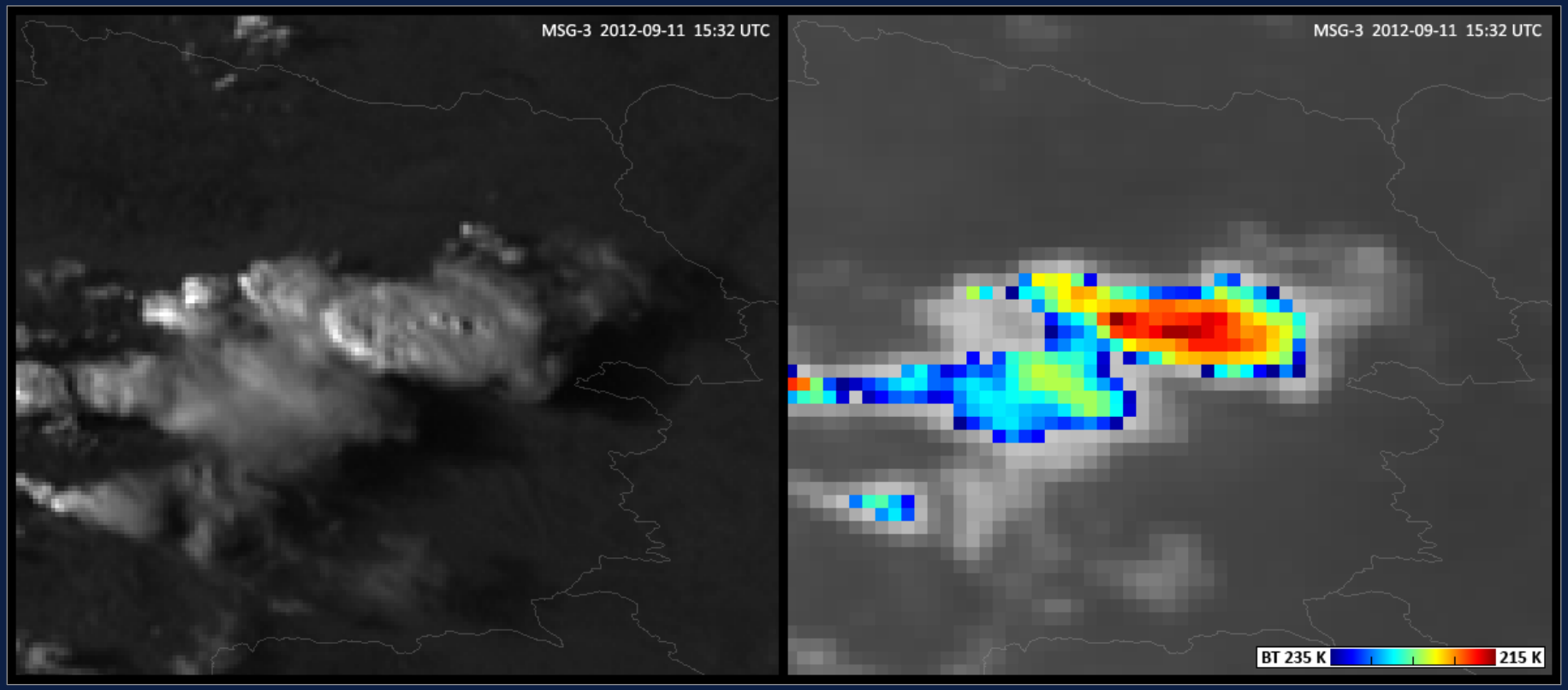
Storms over Austria – example of variable duration of the individual overshooting tops as seen in HRV and color-enhanced IR10.8-BT images (15:30-15:50 UTC)

For a longer coverage of these storms see the movie files: MOV or MP4 format.



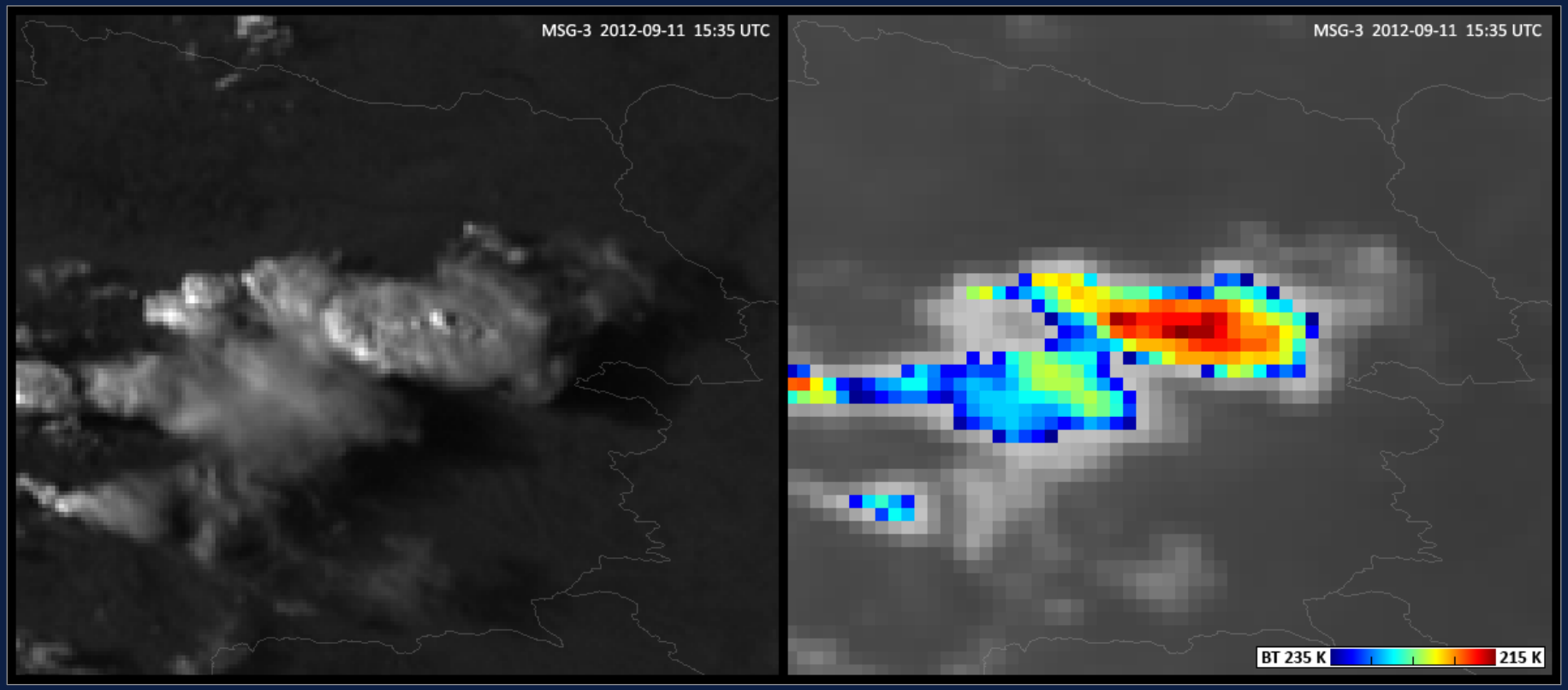
HRV IR10.8

Features to notice: short duration of the individual overshooting tops (OT), some of them present in one single image only (e.g. the one at 15:45). However, most of the OTs can be traced for 2 or 3 images following their first appearance. This is in agreement with their presently estimated life time (based on other observations), between 5 to 15 minutes. Most of these OTs are not co-located with the coldest pixels.



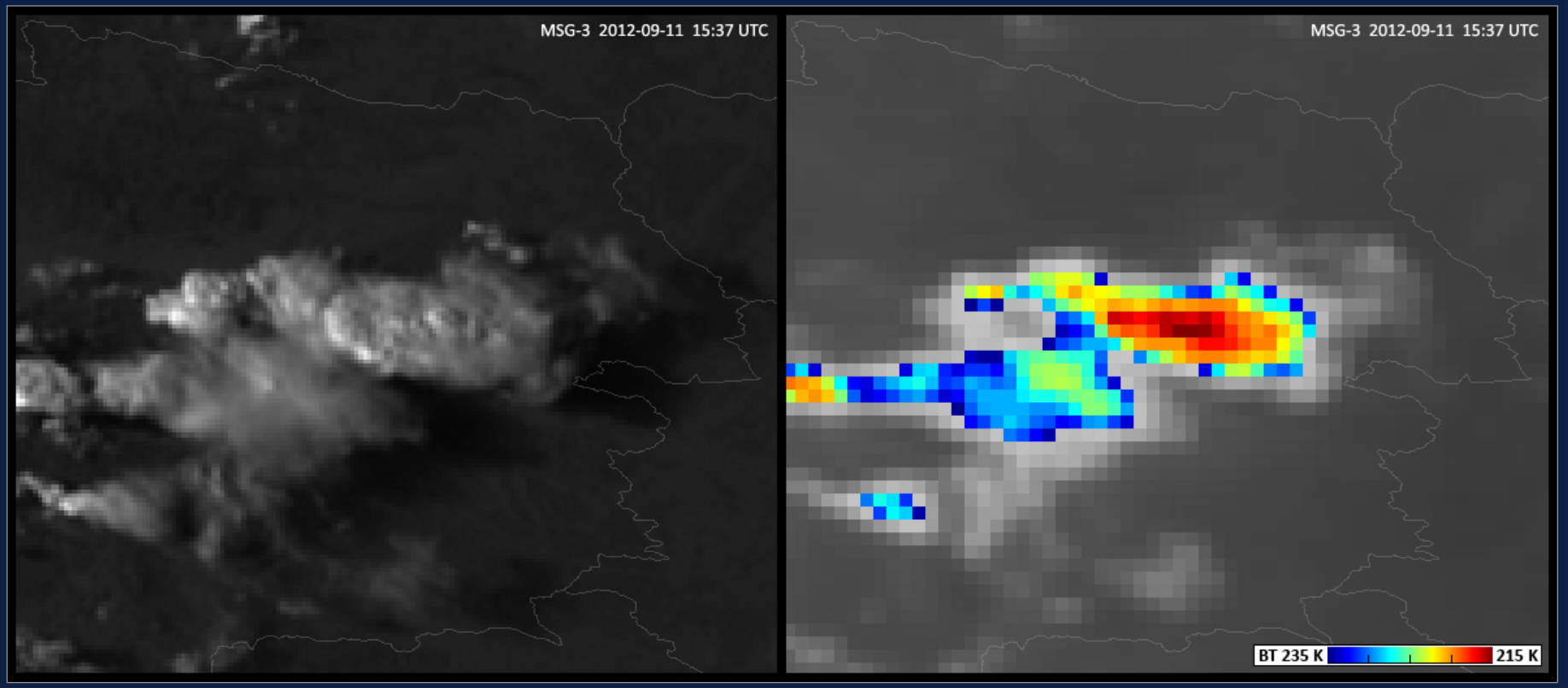
HRV

IR10.8



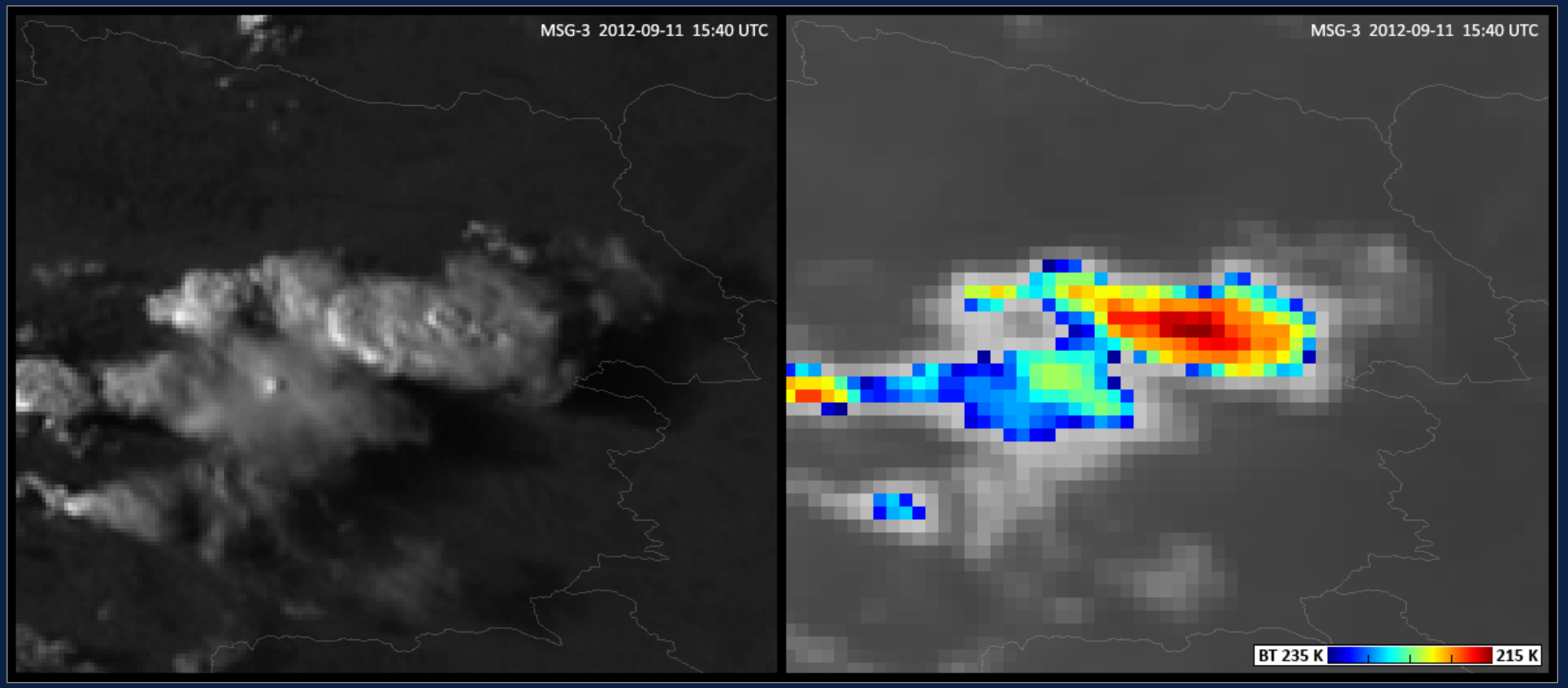
HRV

IR10.8



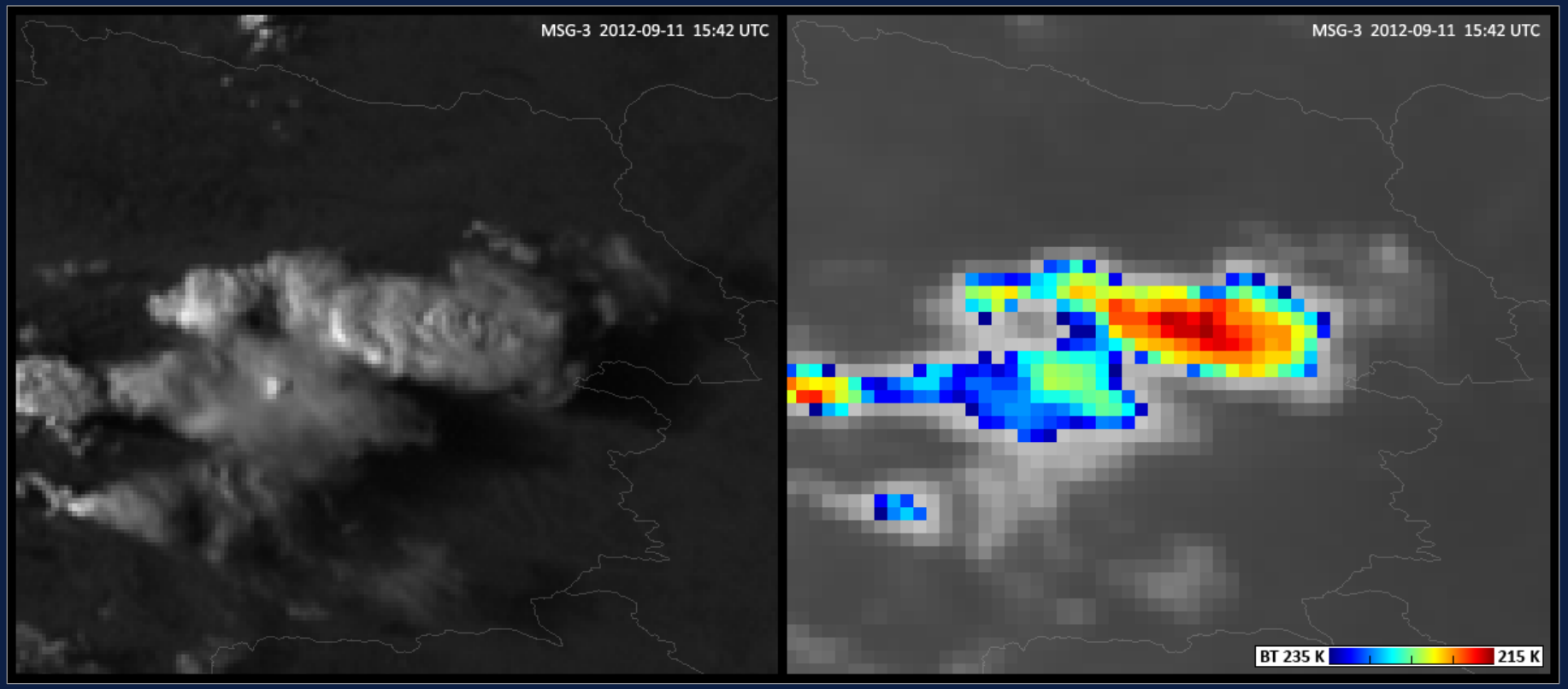
HRV

IR10.8



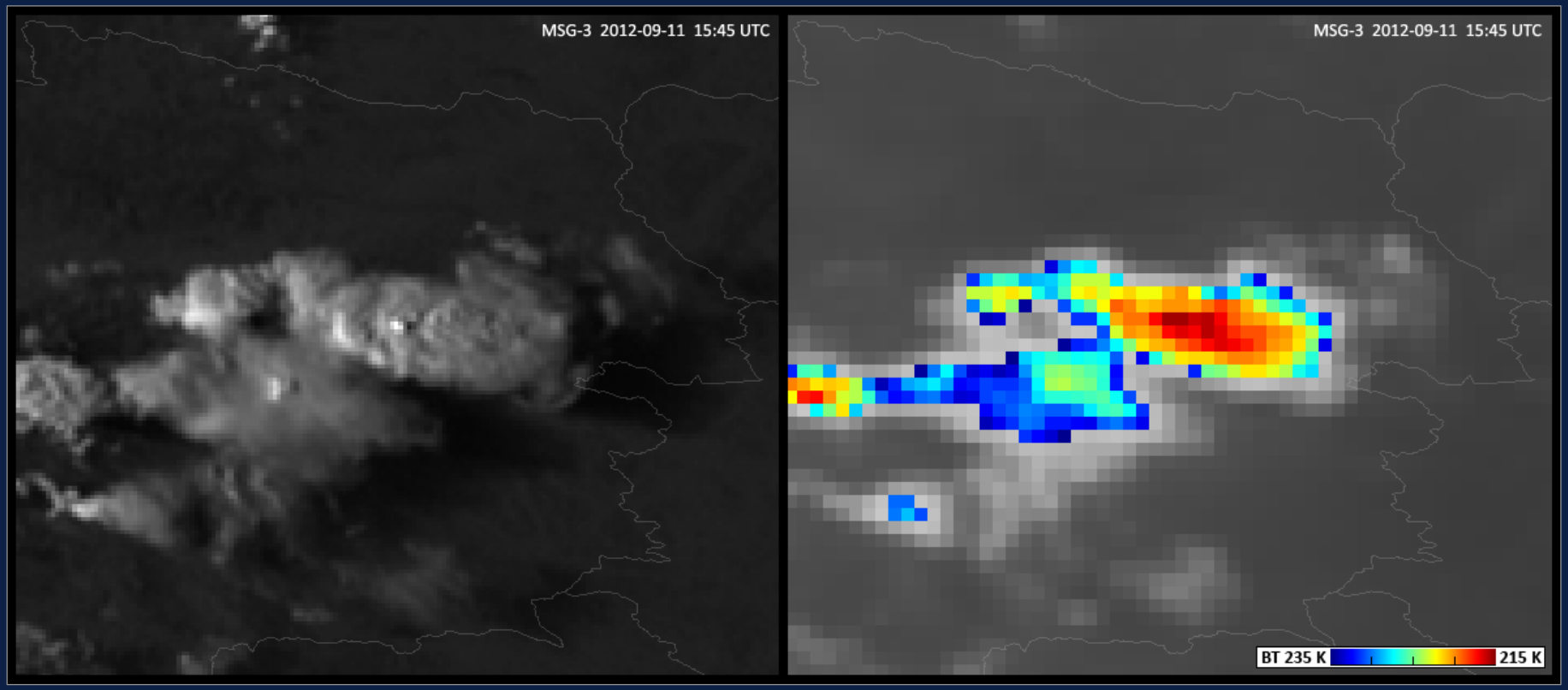
HRV

IR10.8



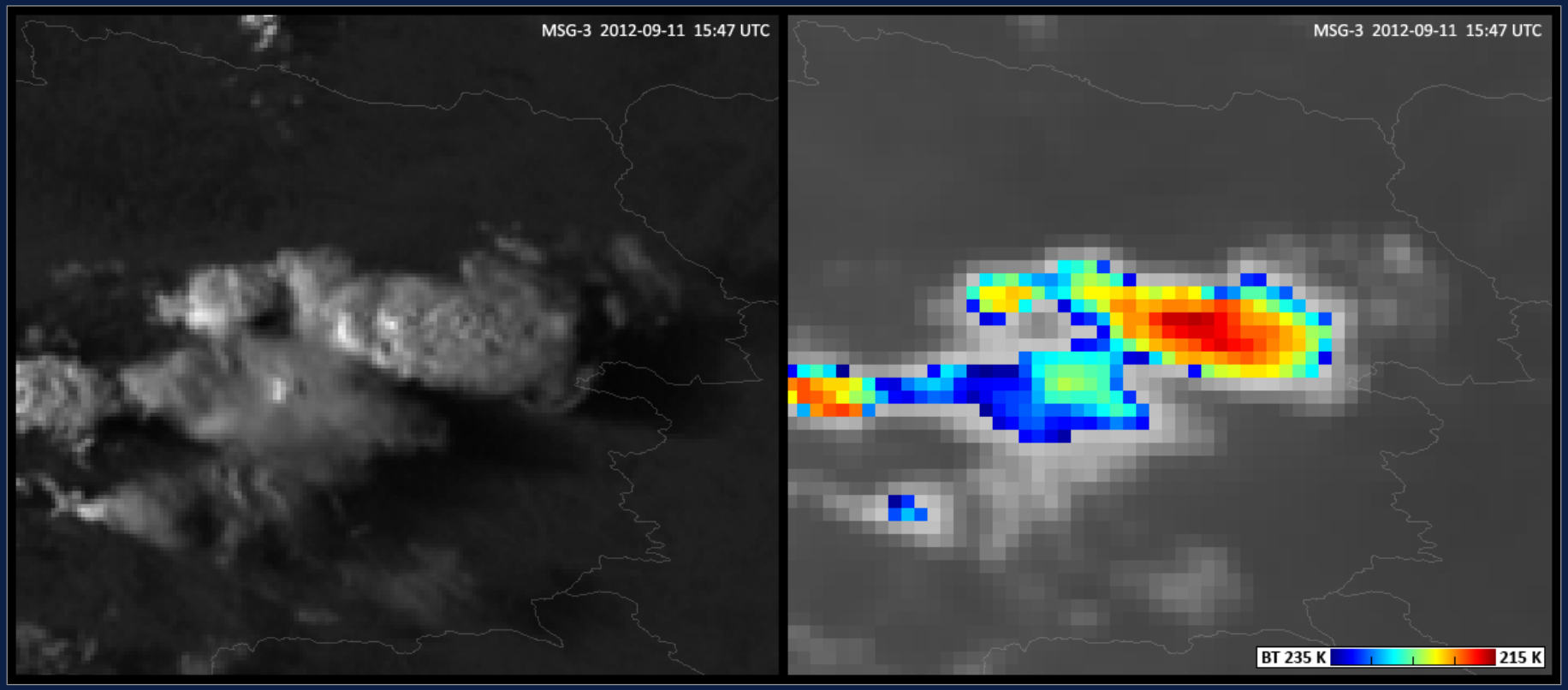
HRV

IR10.8



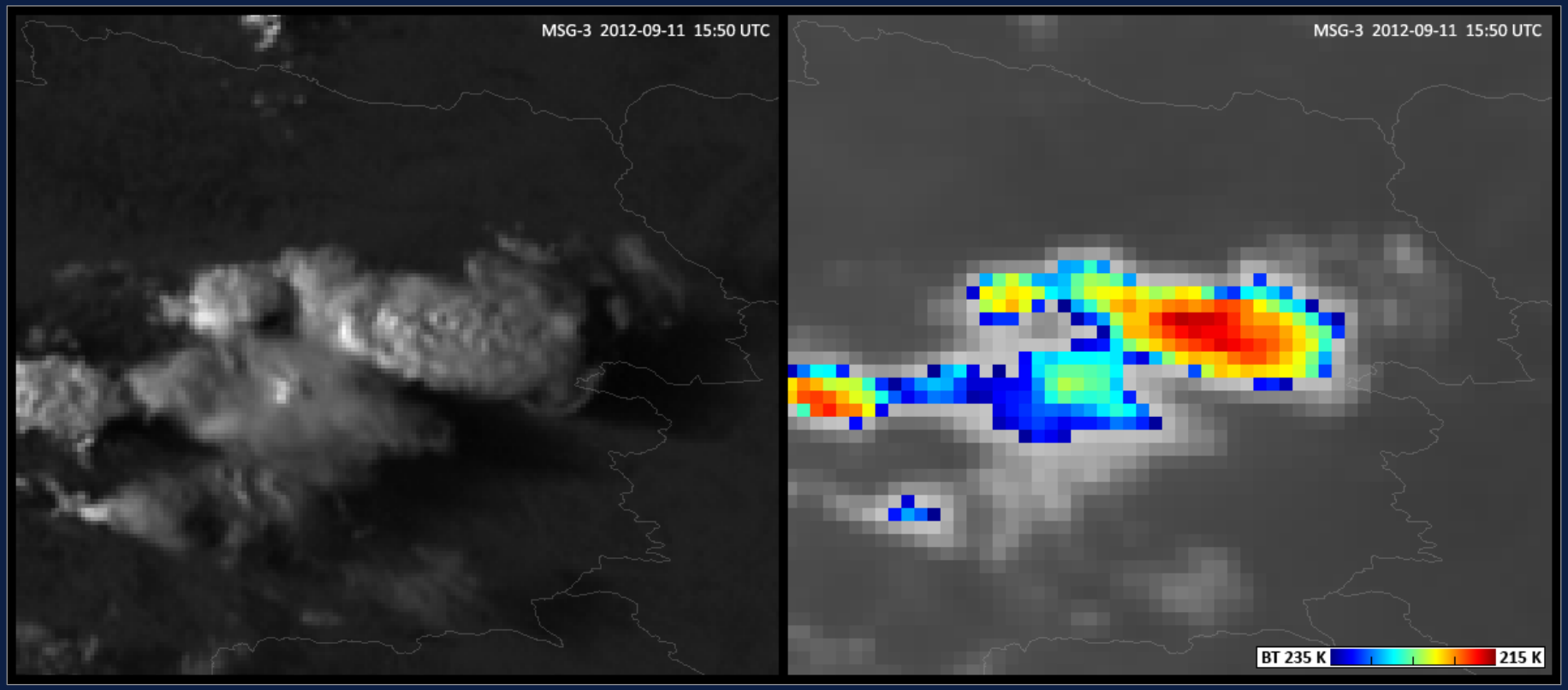
HRV

IR10.8



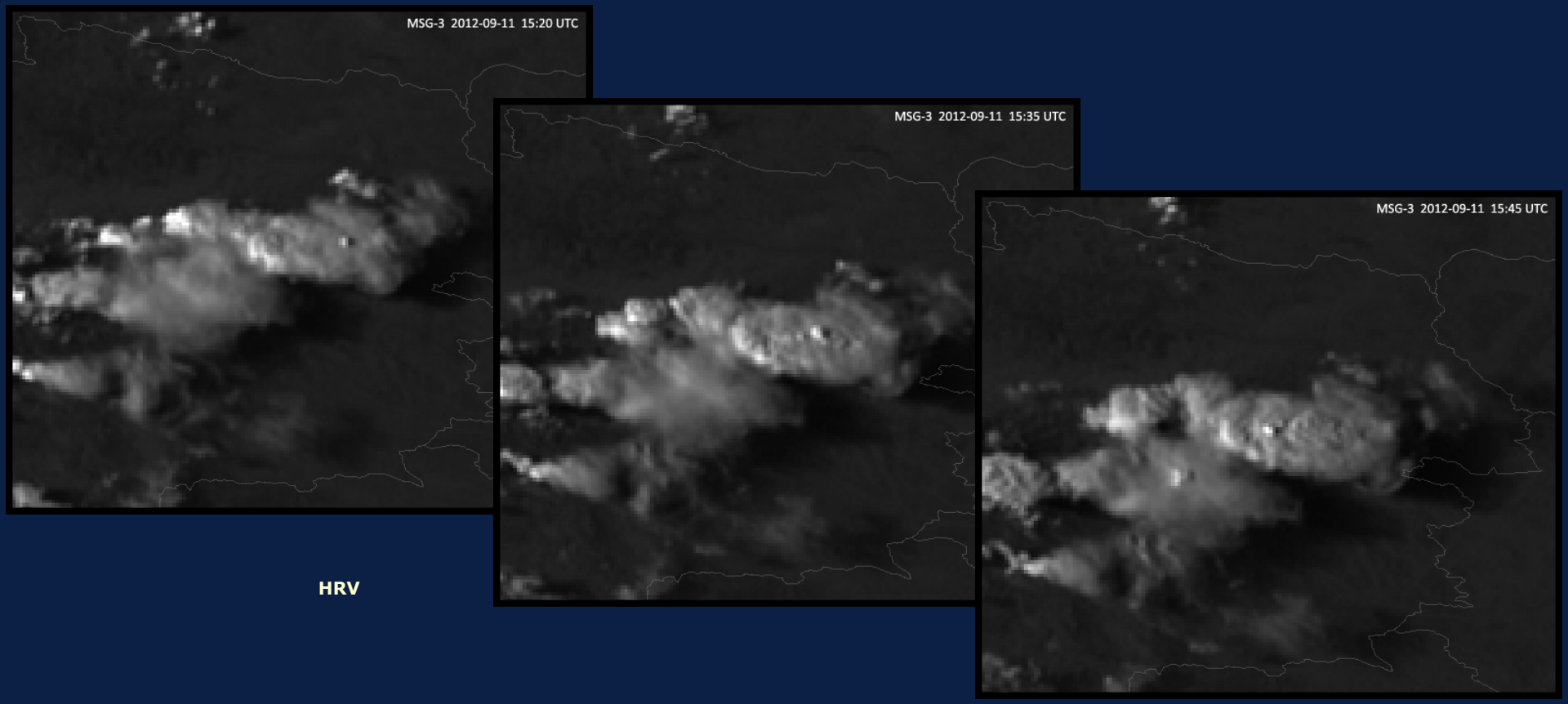
HRV

IR10.8



HRV **IR10.8**

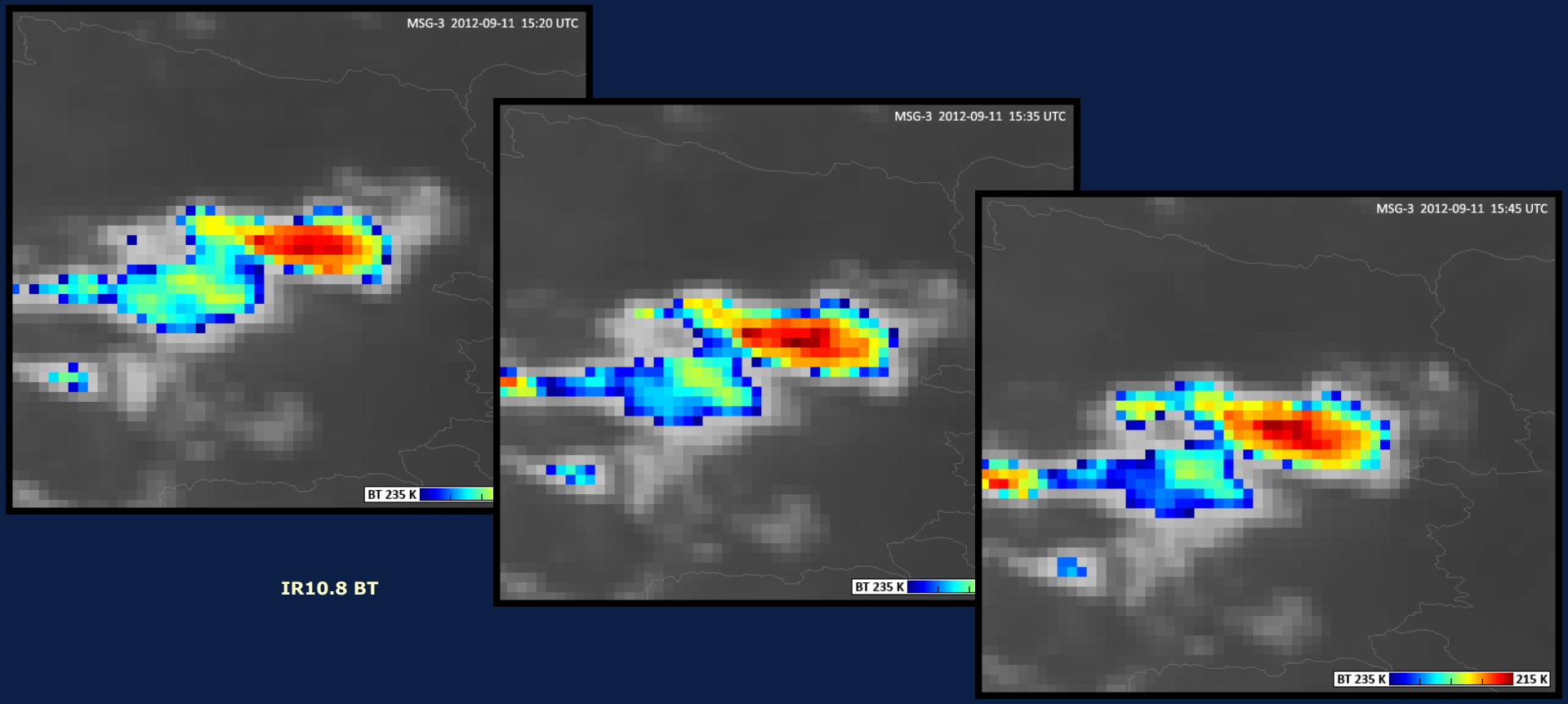
Storms over Austria – several examples of relative position of the overshooting tops as seen in HRV and coldest pixels in the color-enhanced IR10.8 BT images



HRV

(go one slide forward for the IR10.8 color-enhanced BT images)

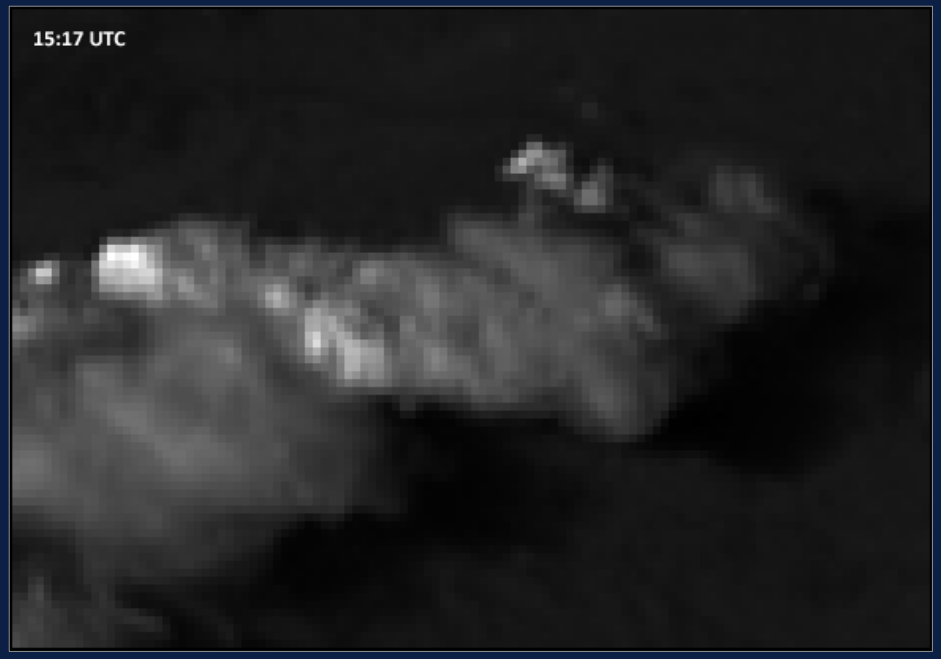
Storms over Austria – several examples of relative position of the overshooting tops as seen in HRV and coldest pixels in the color-enhanced IR10.8 BT images



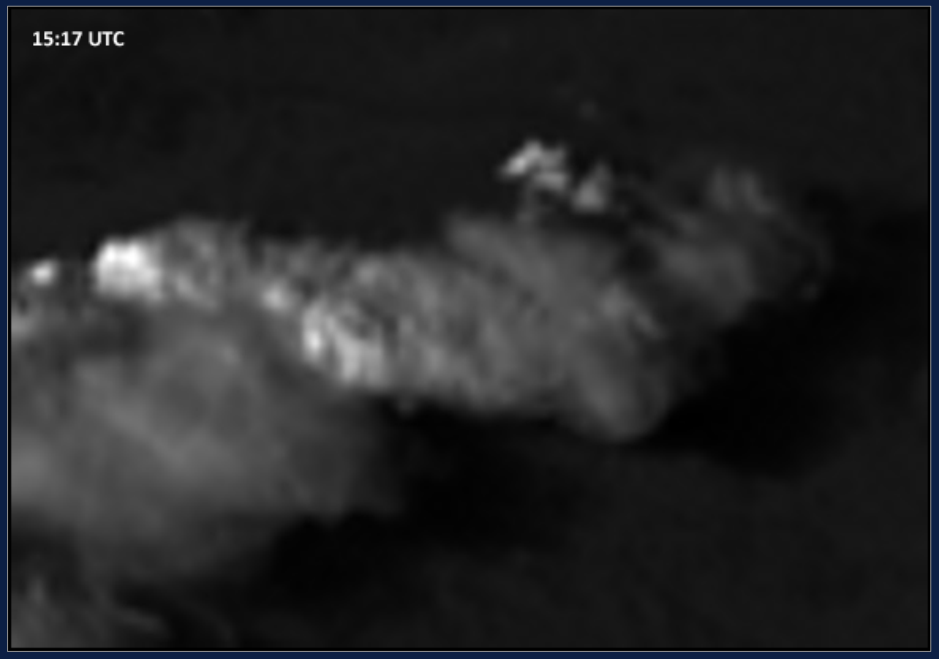
IR10.8 BT

(go one slide back for the corresponding HRV images)

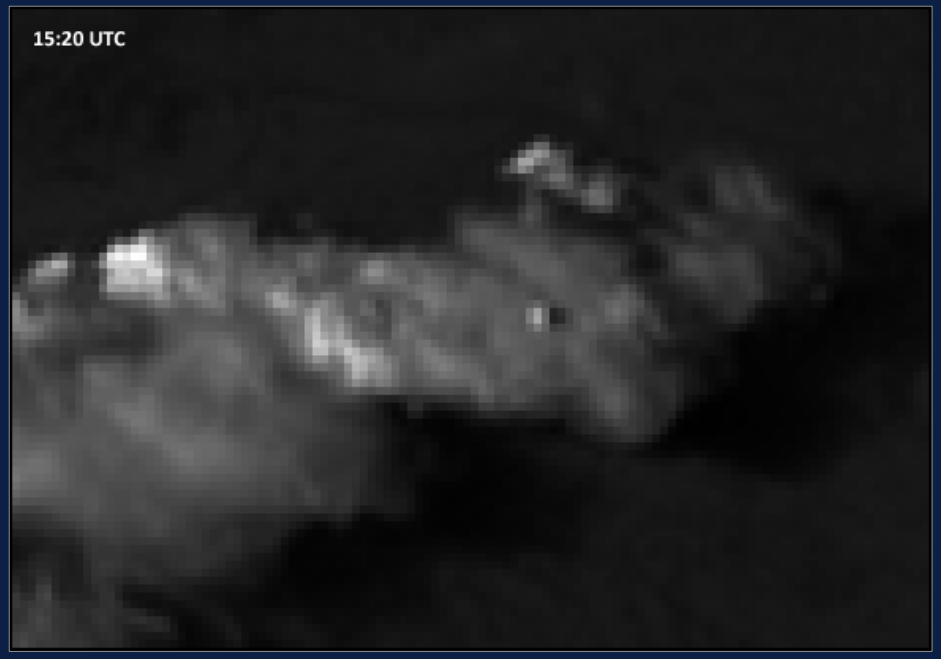
Storms over Austria – detailed view of the overshooting tops in HRV, 15:17-15:47 UTC

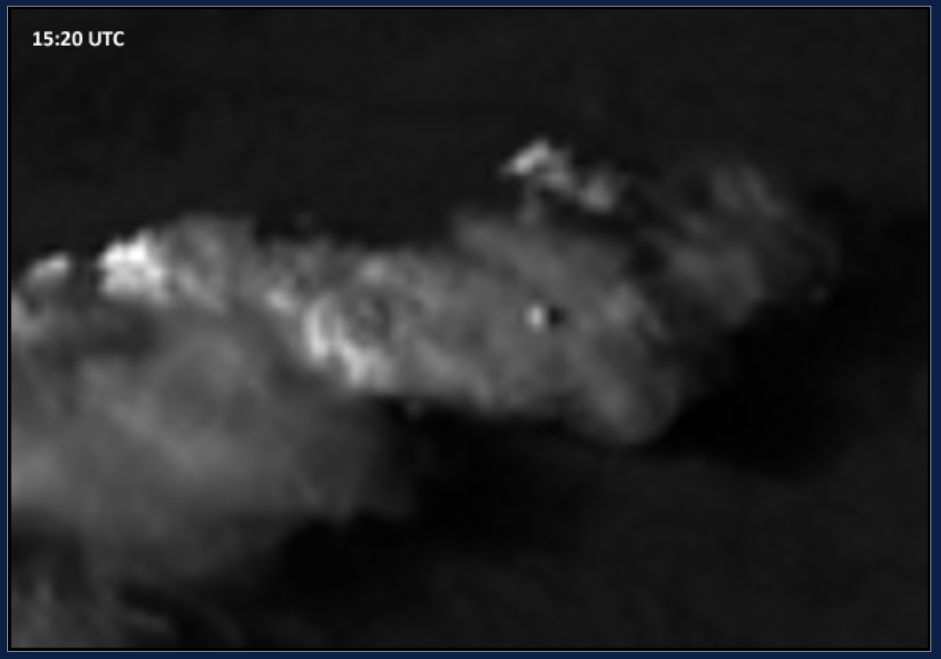


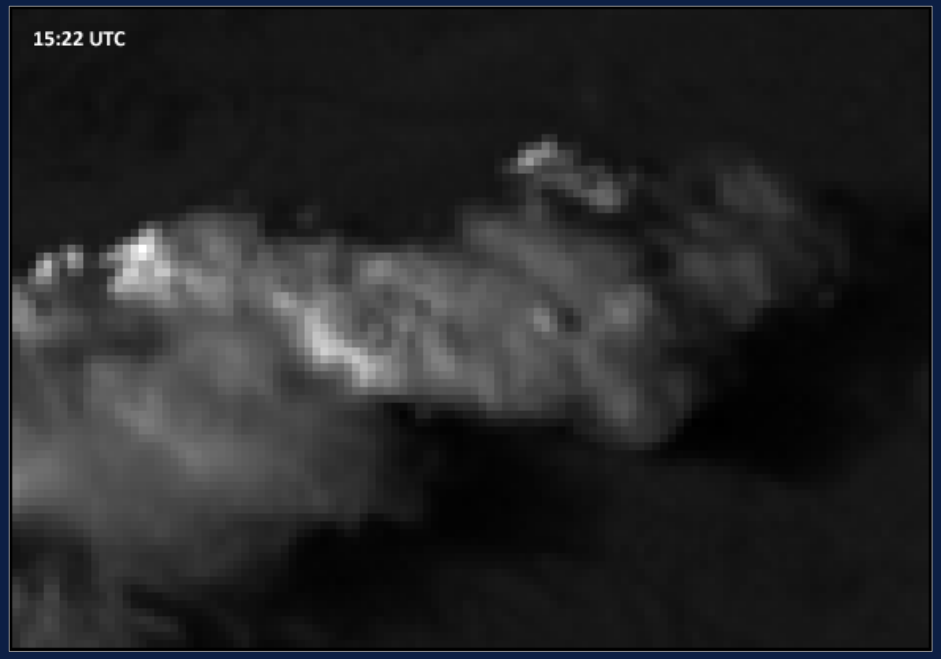
HRV band in the original satellite projection, zoomed using the nearest neighbor resampling method.

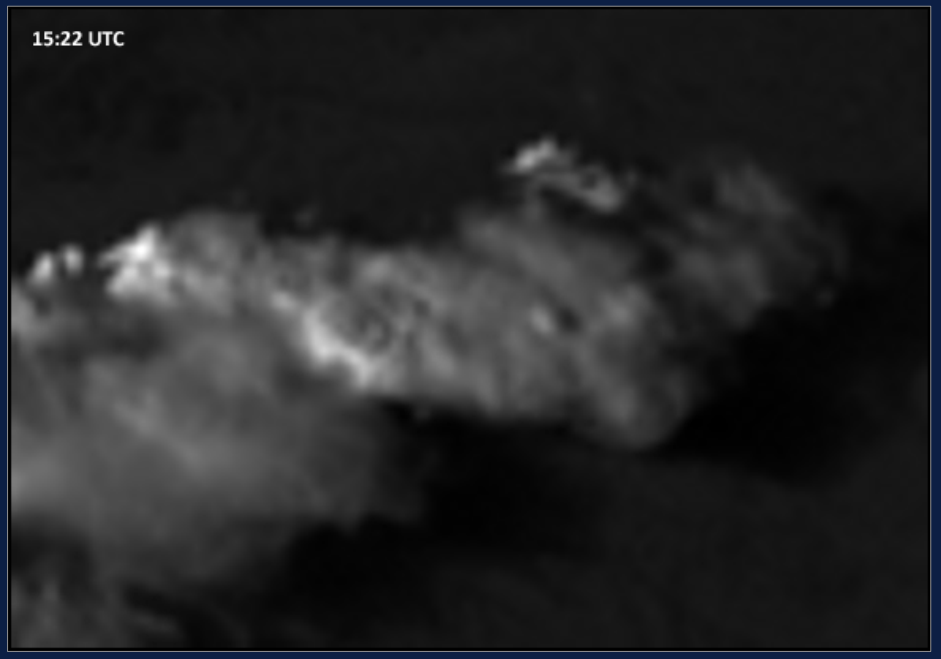


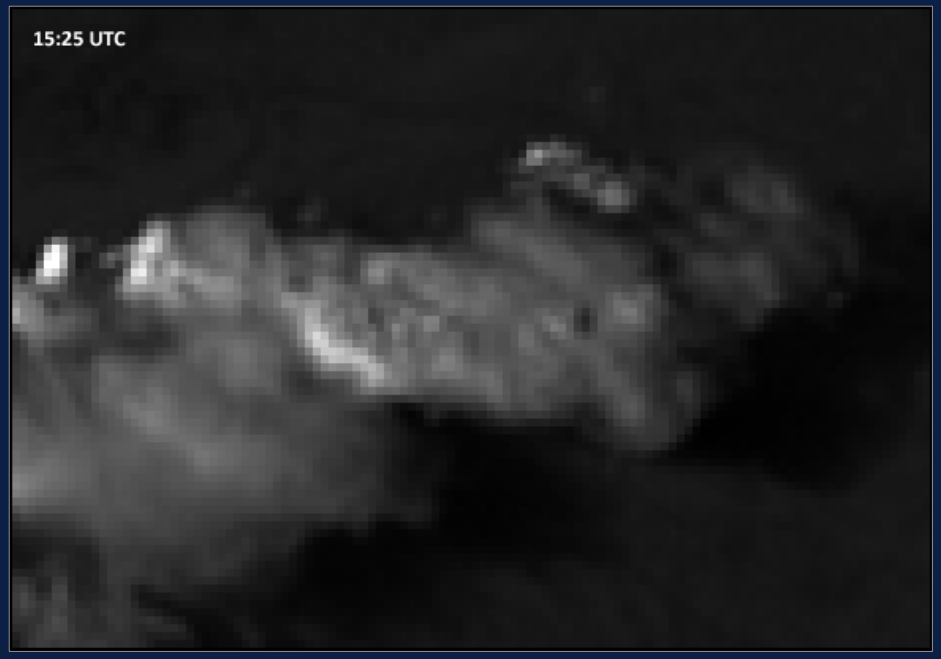
The same HRV image as left, but zoomed using the ENVI "optimized bicubic" method.

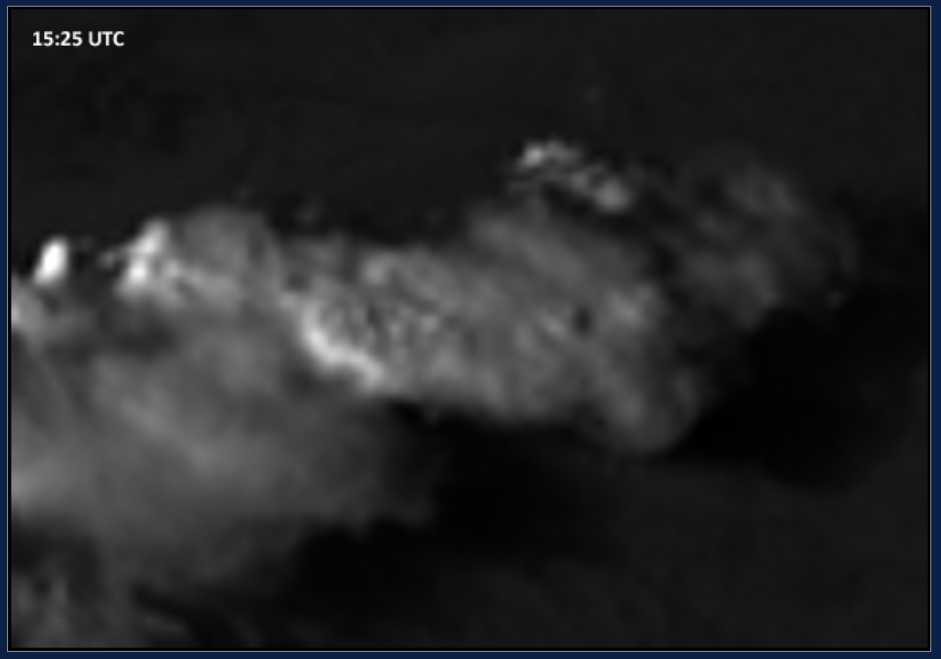

15:20 UTC

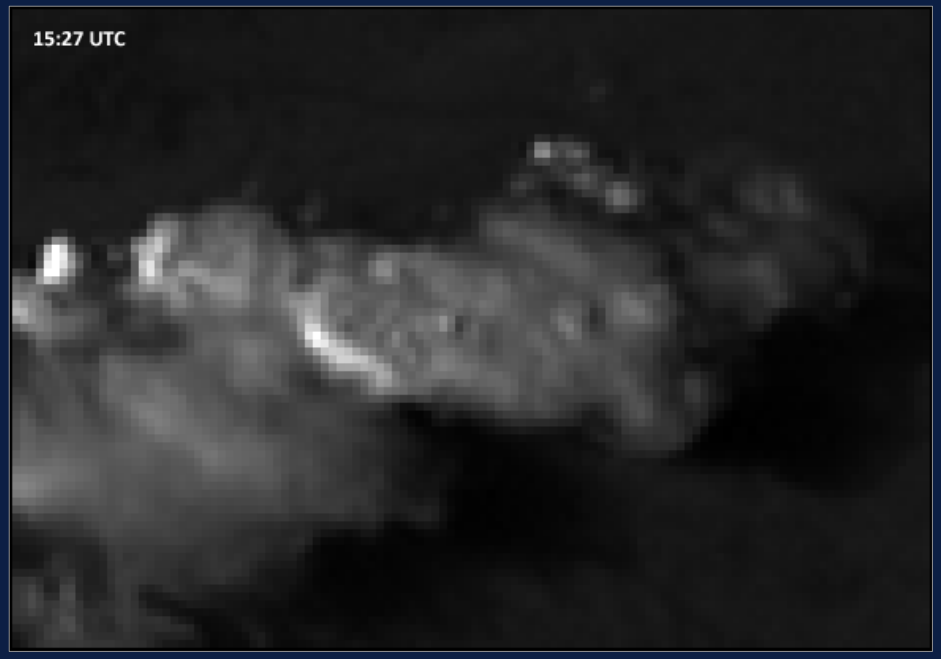

15:20 UTC

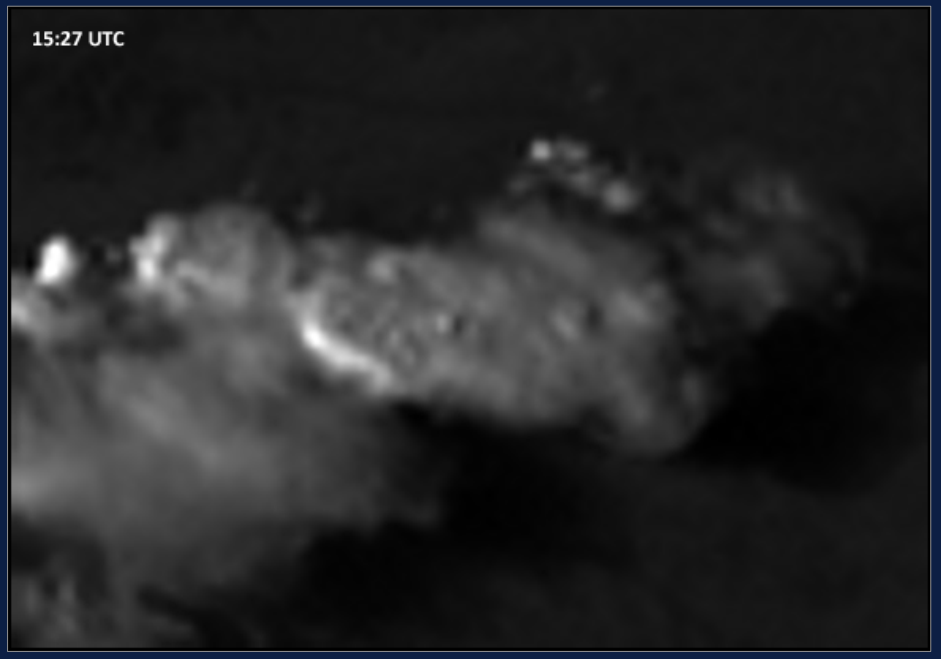

15:22 UTC

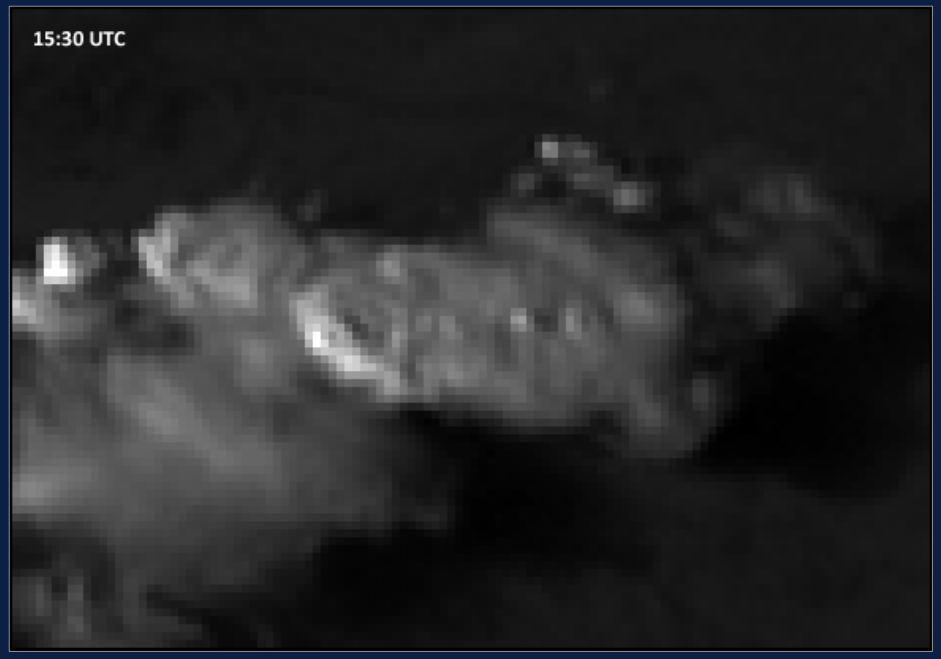

15:22 UTC

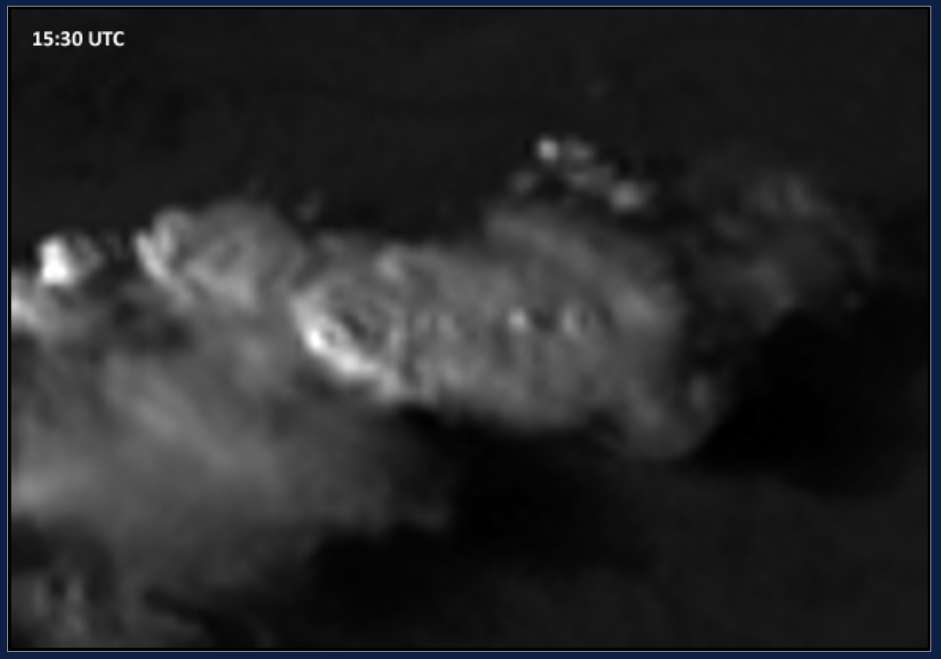

15:25 UTC

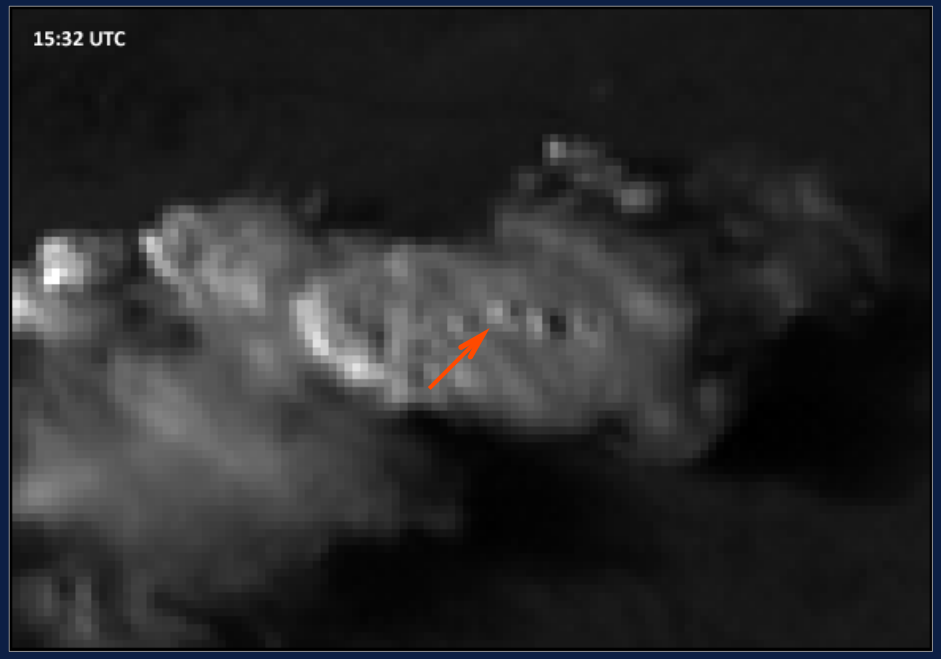

15:25 UTC

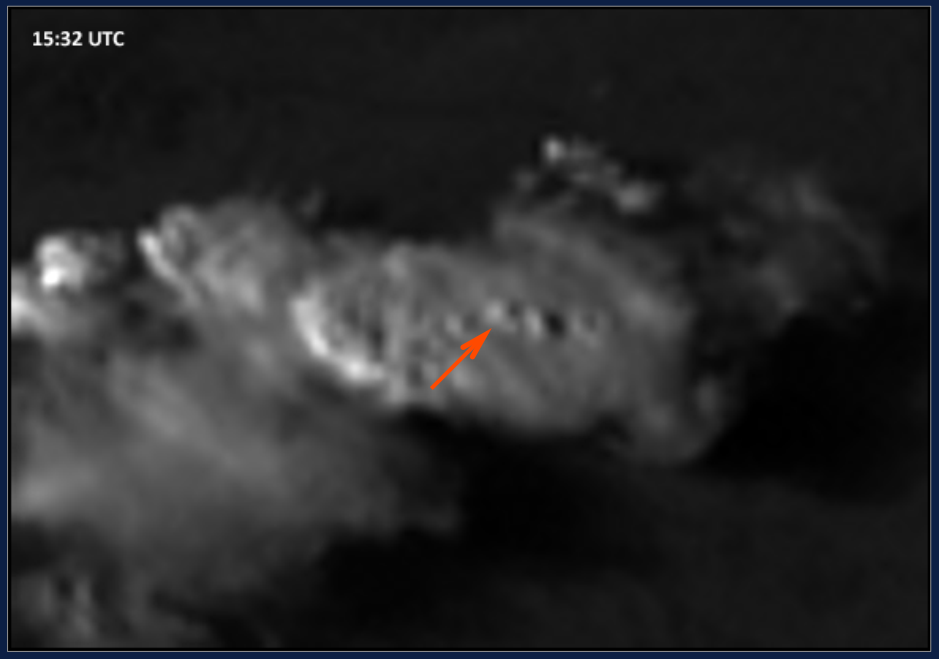

15:27 UTC


15:27 UTC

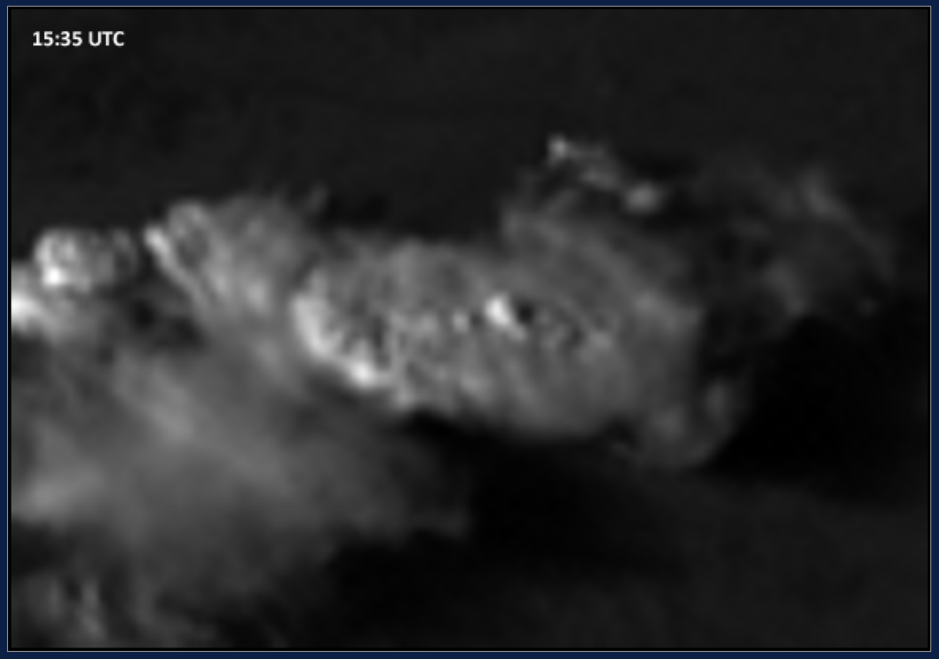

15:30 UTC


15:30 UTC





Follow the next evolution of this overshooting top – in the next image (15:35) it seems to culminate, forming a central depression (OT oscillation?) in the two follow-up images (15:37 and 15:40). This feature (the central depression) shouldn't be confused with cold-rind features – different scale of these!



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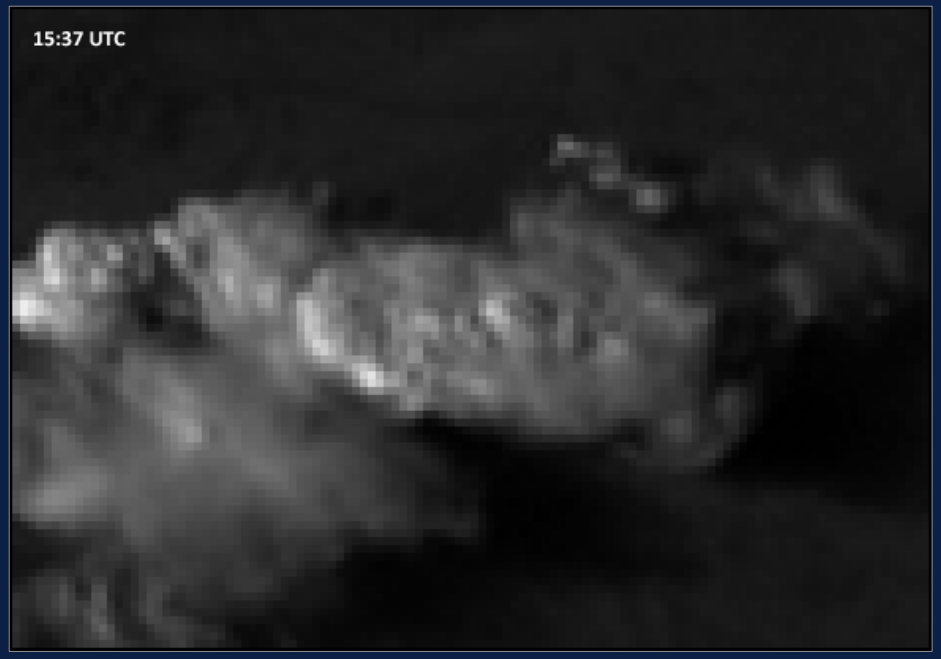

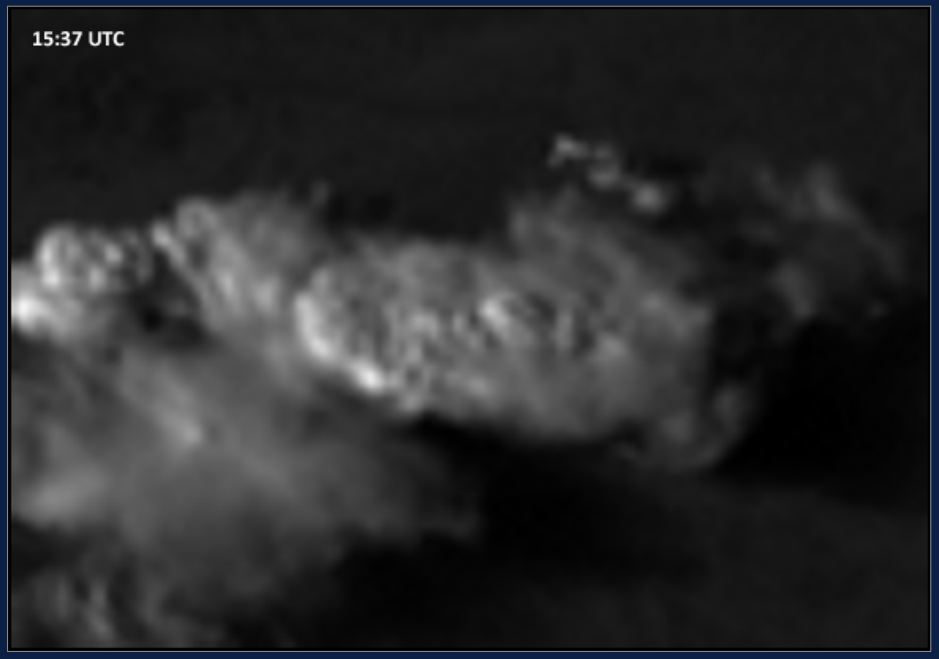

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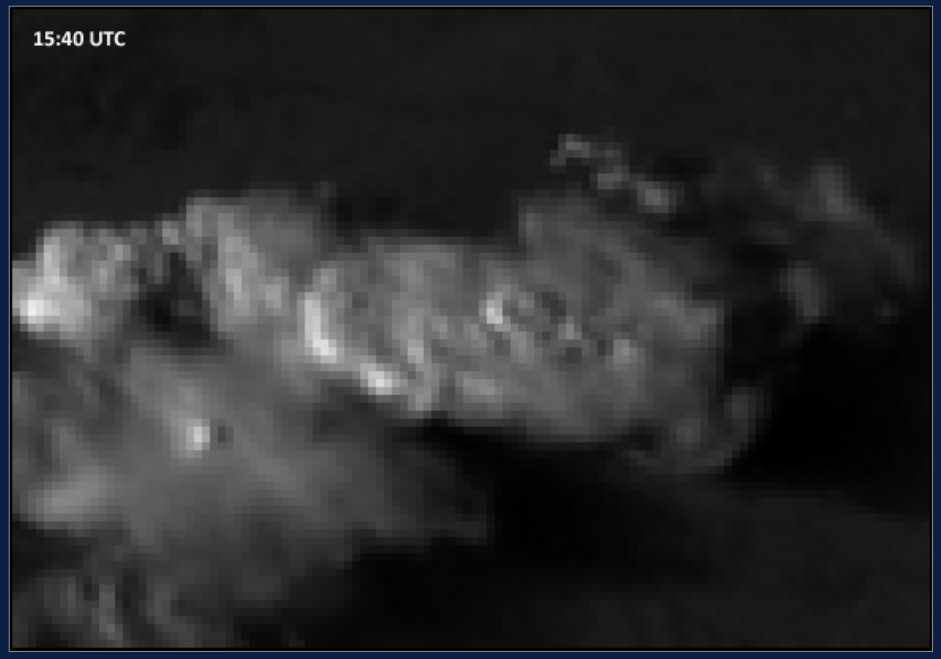

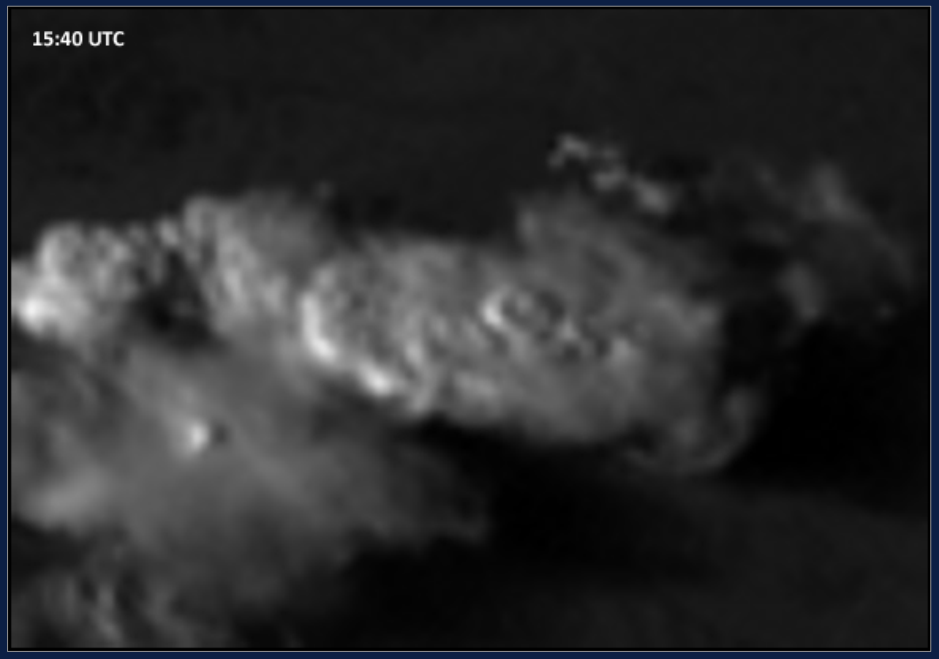

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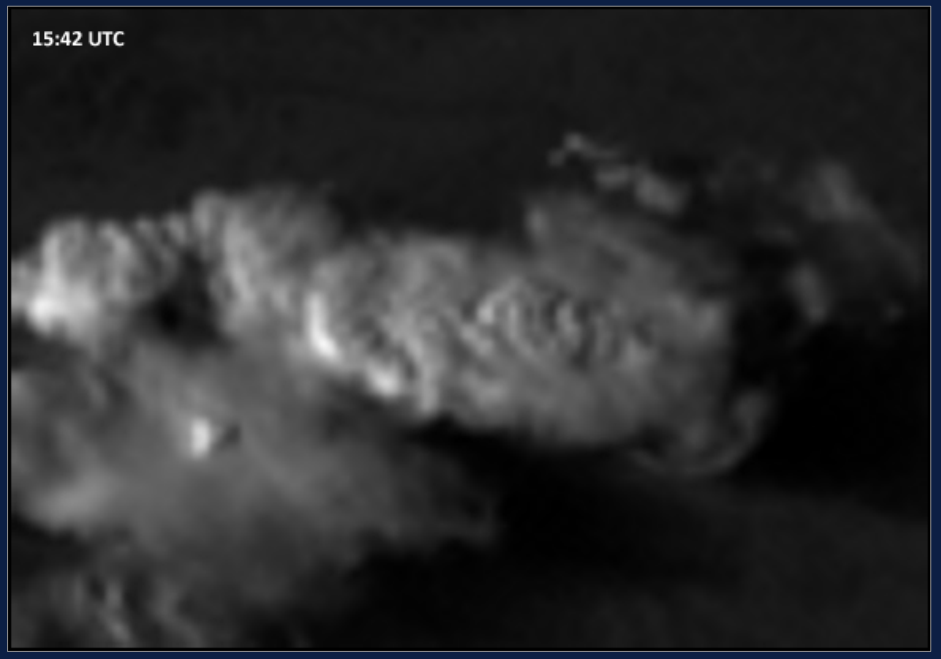
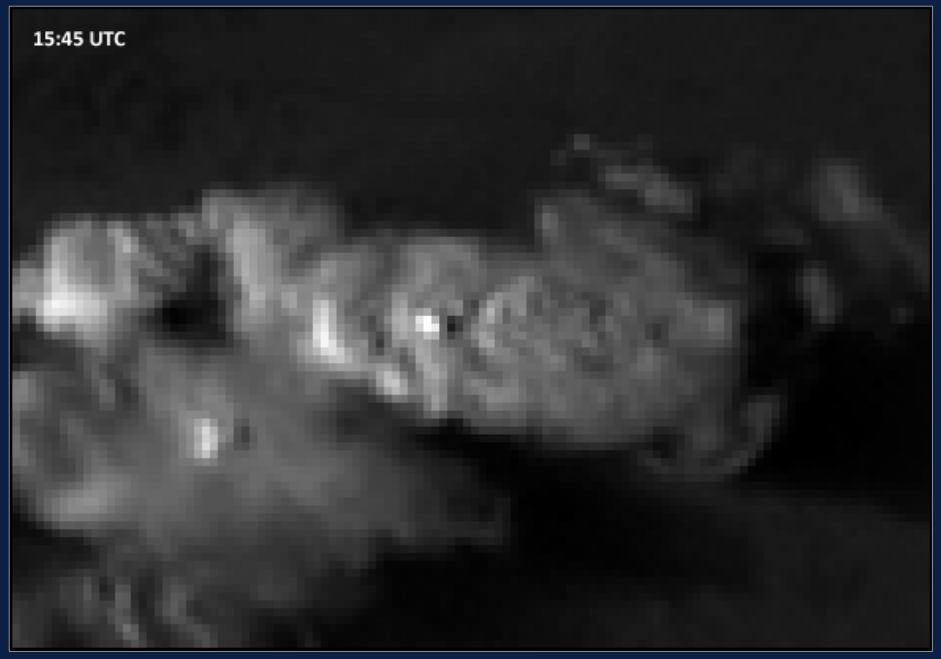
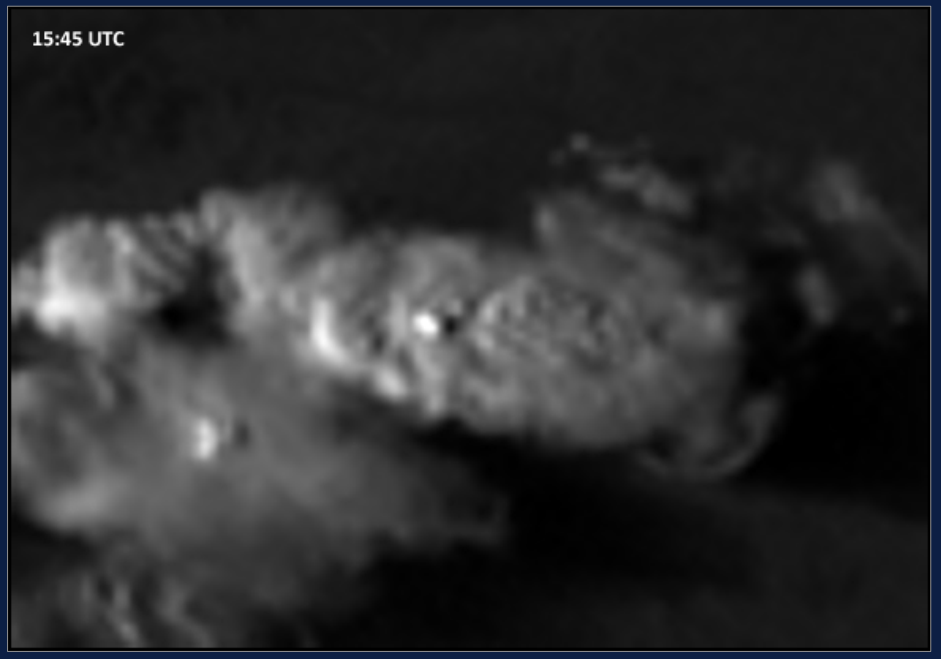
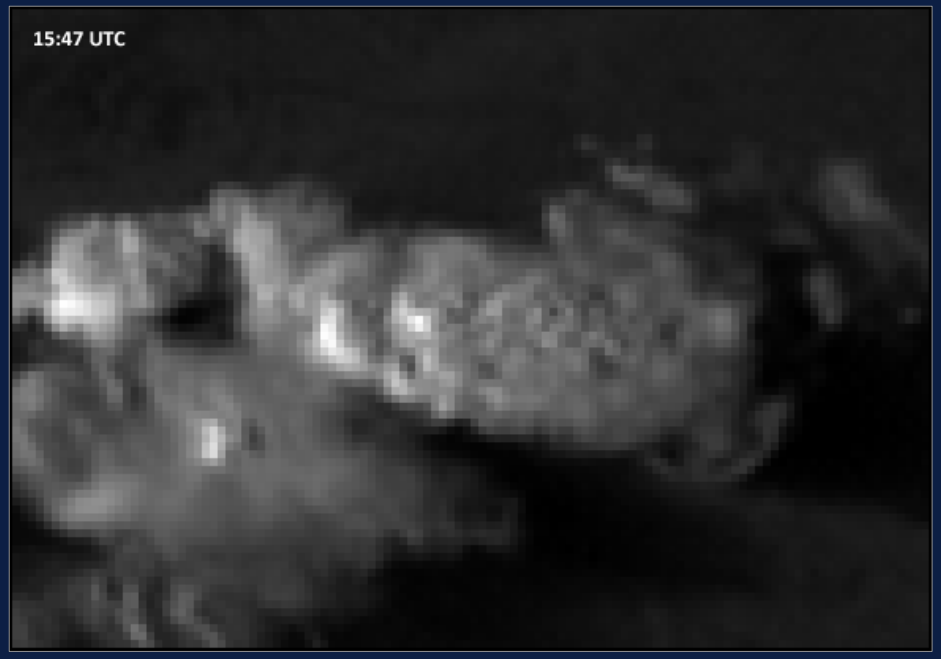
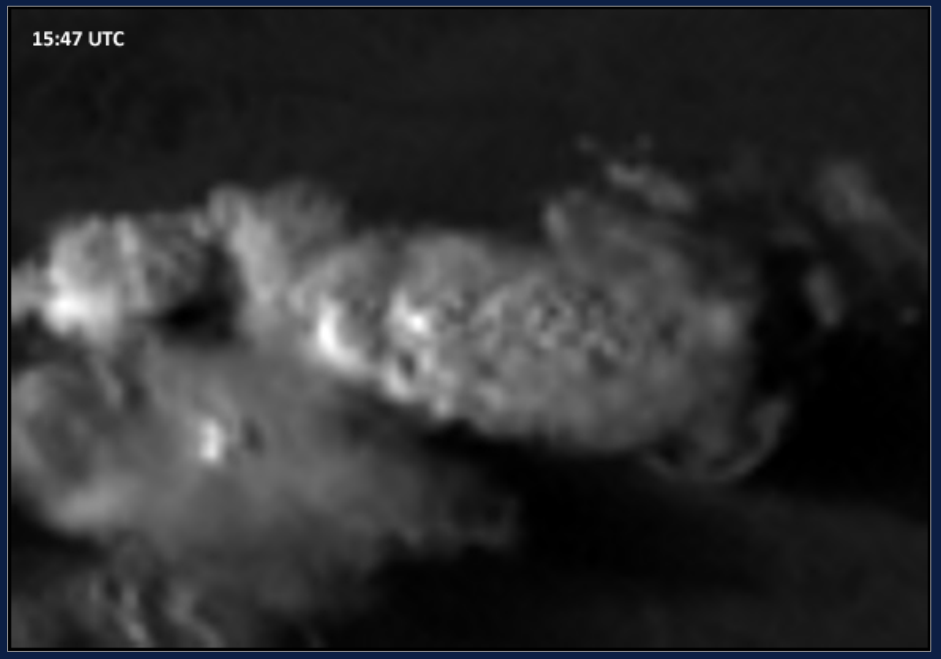
15:42 UTC


15:42 UTC


15:45 UTC


15:45 UTC

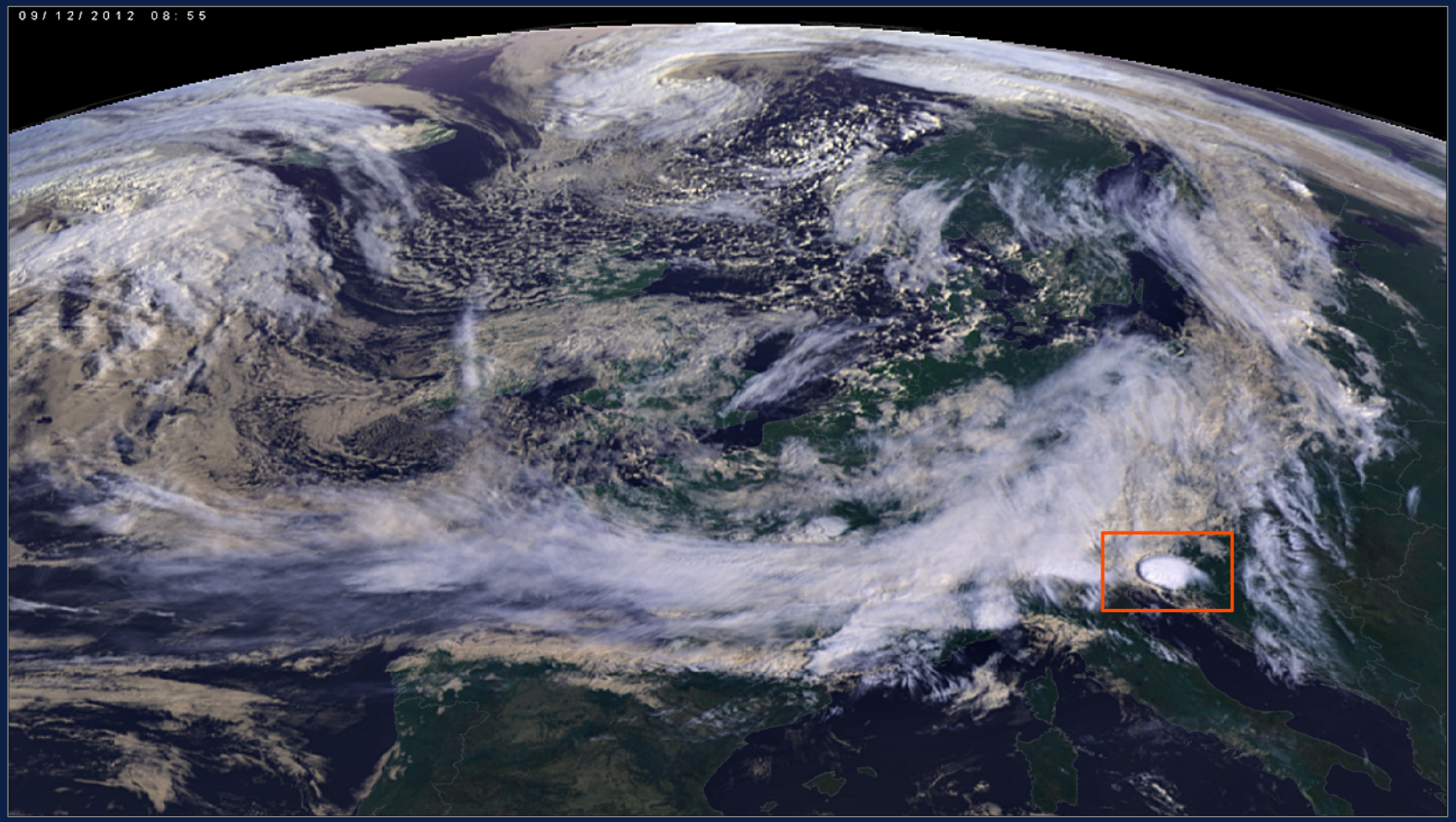

15:47 UTC


15:47 UTC

12 September 2012 (early morning)

storms over northeast Italy

Storms over northeast Italy, 11 September 2012, 06:00 – 08:55 UTC



For full evolution of these storms (in red rectangle) see the following movie files:

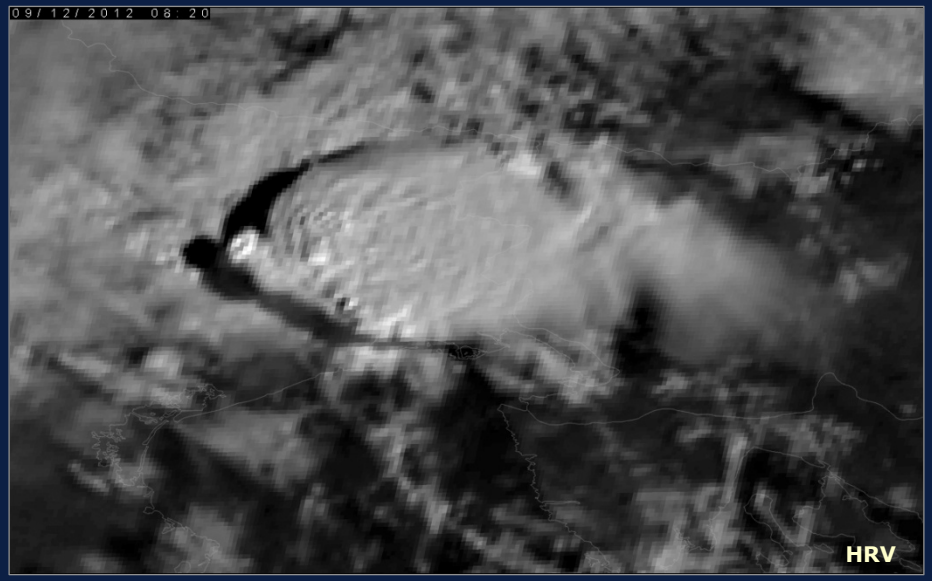
HRV

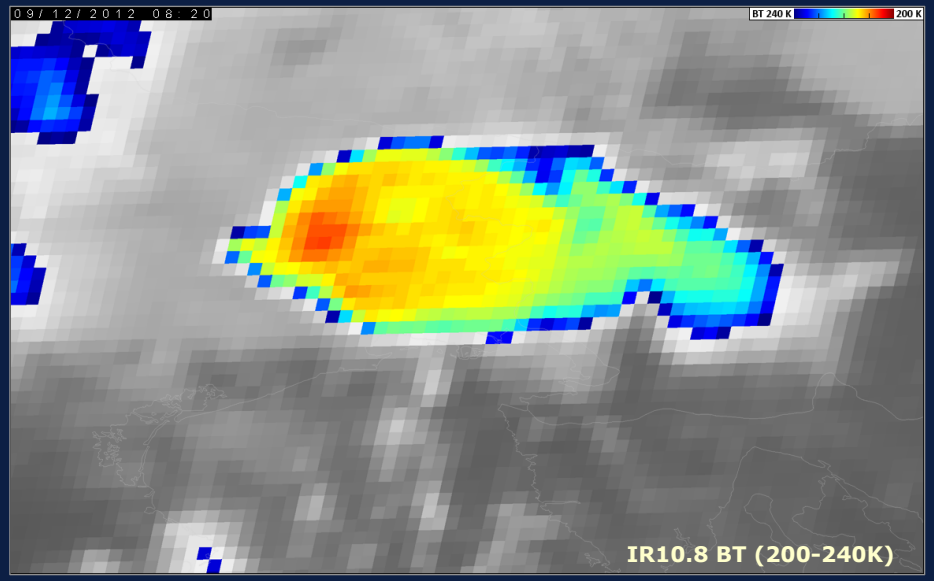
IR10.8-BT (200-240K)

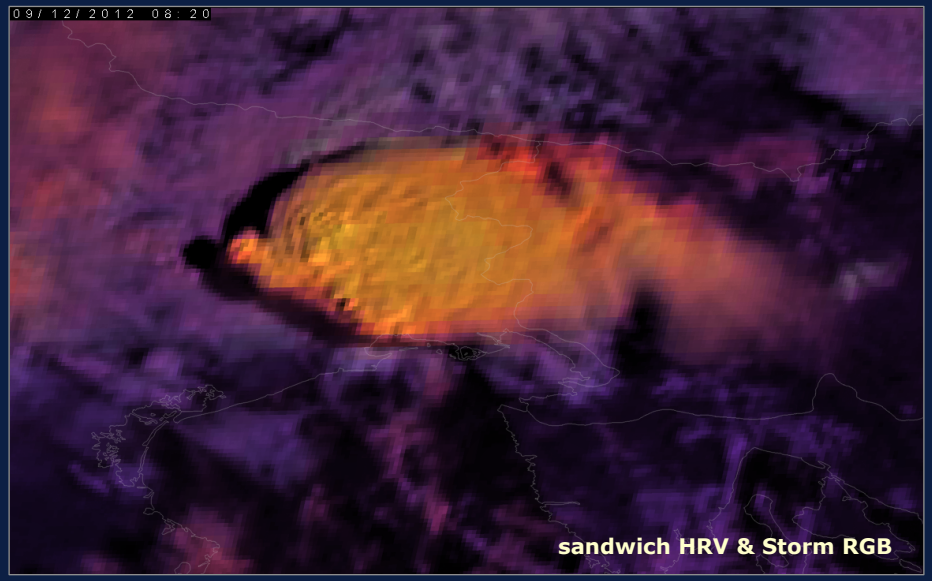
sandwich HRV & Storm RGB

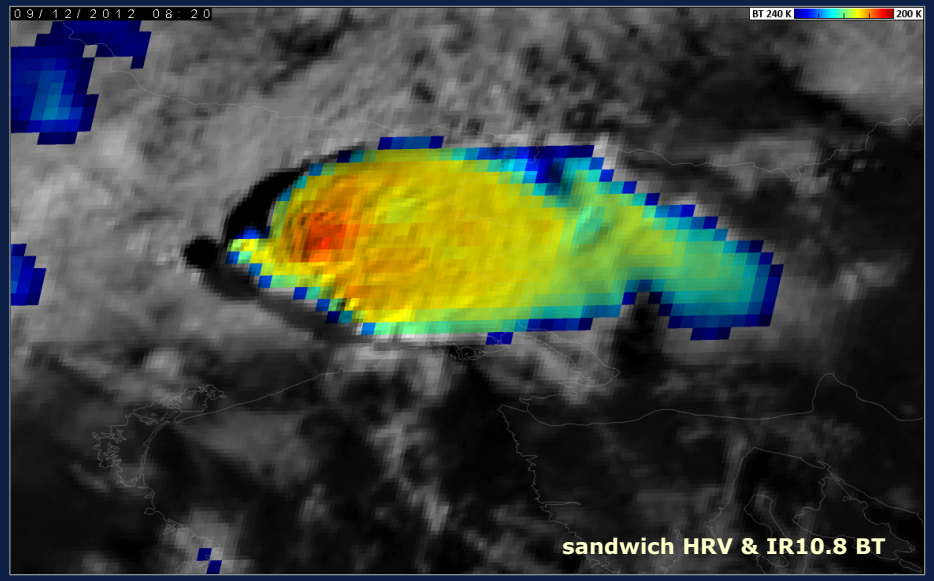
sandwich HRV & IR10.8-BT

Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

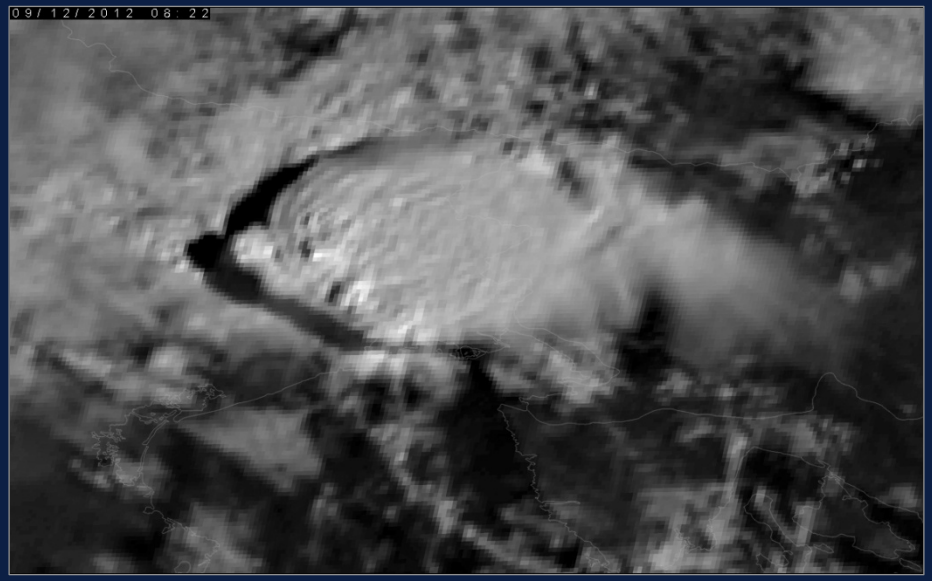


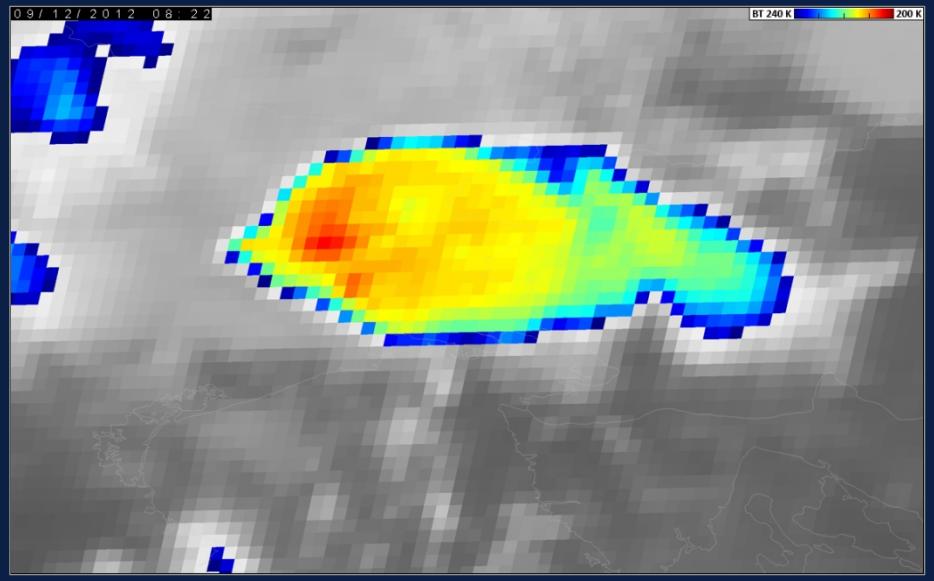


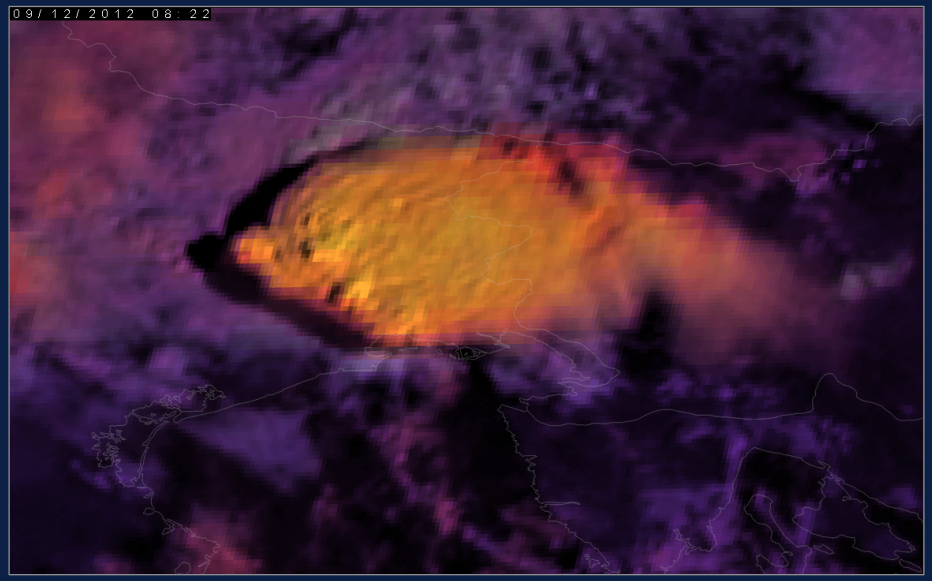


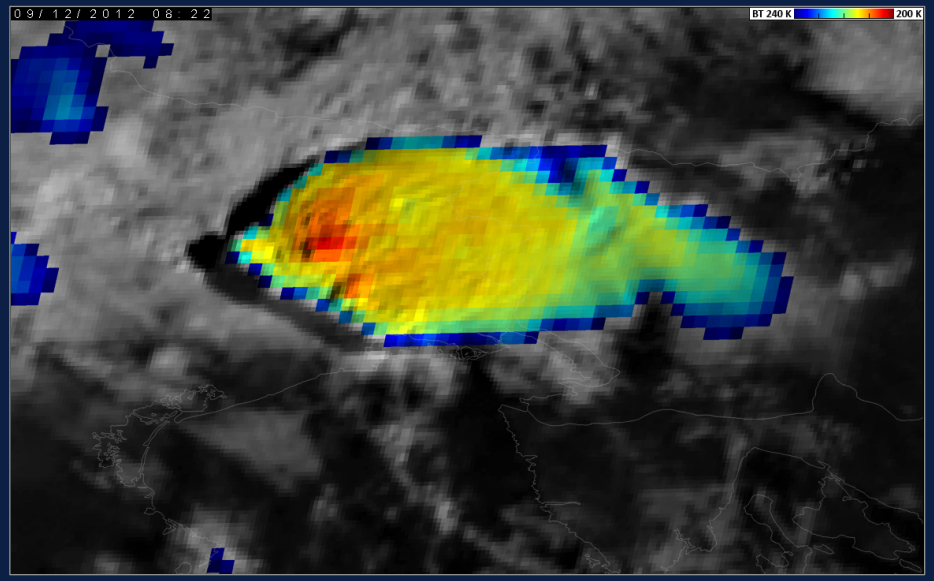


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

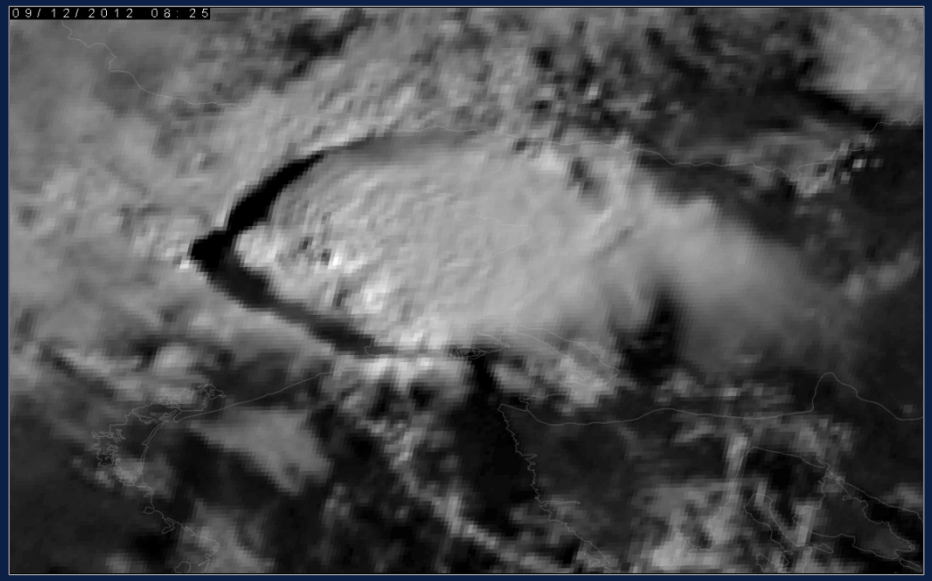


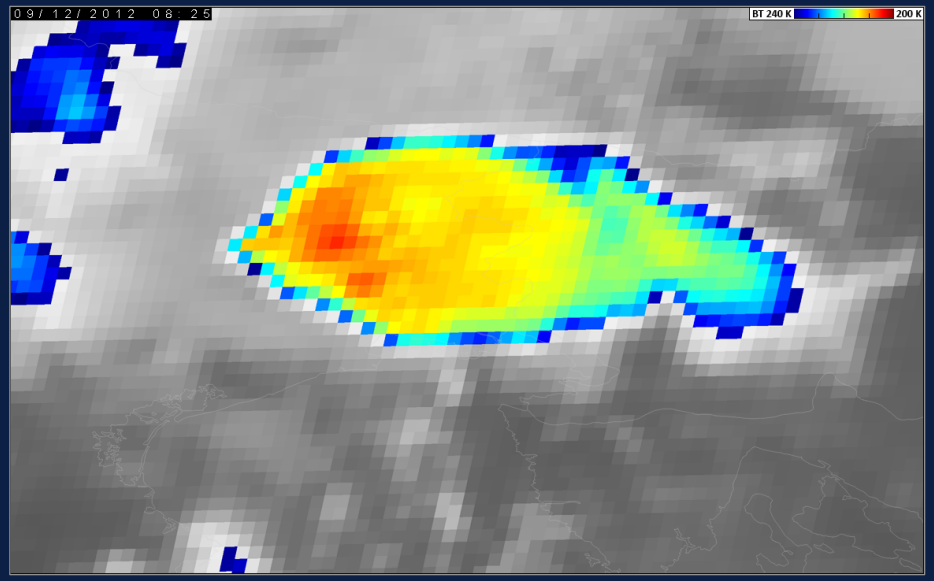


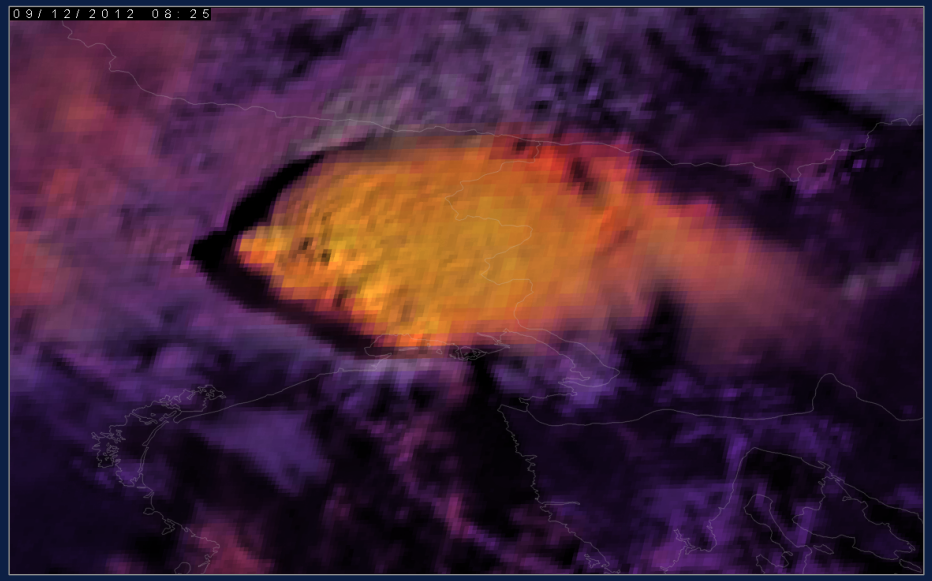


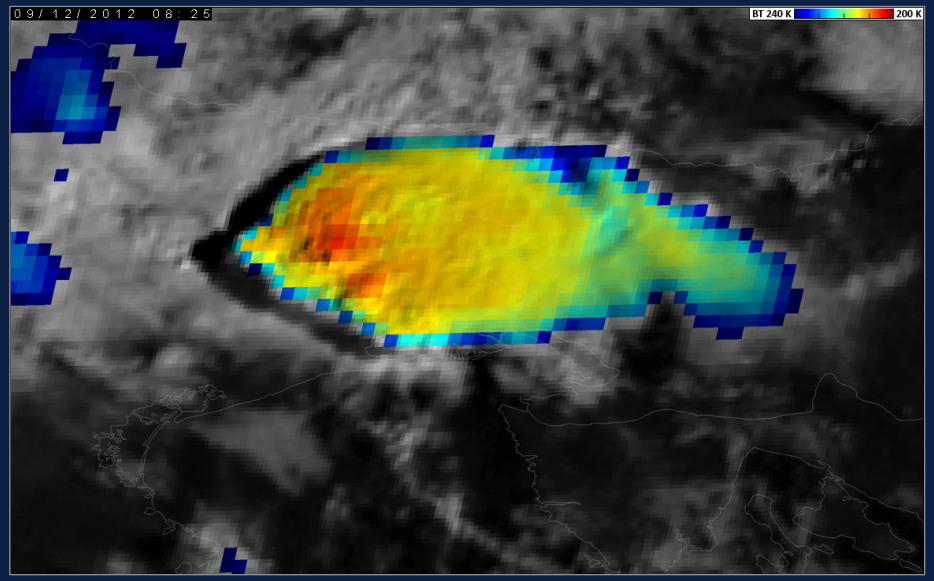


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

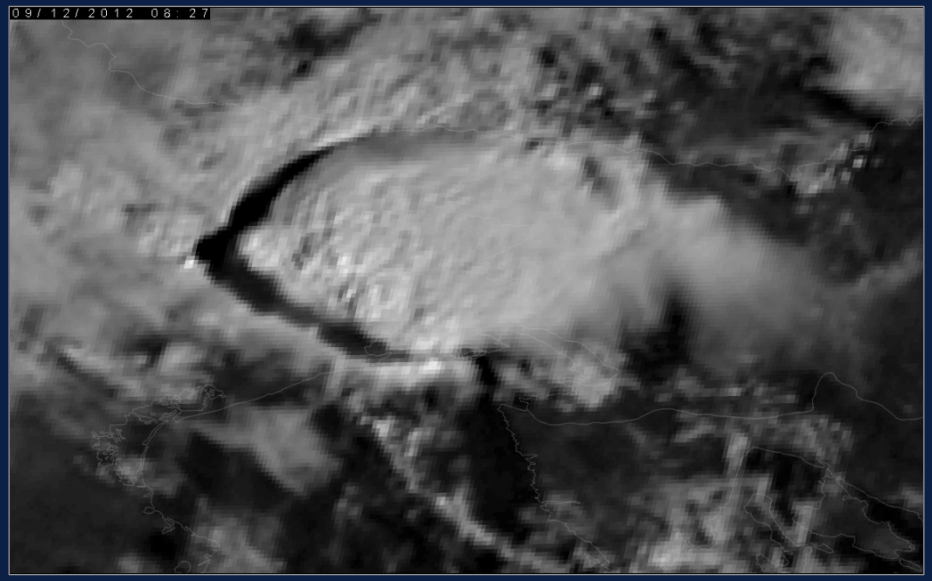


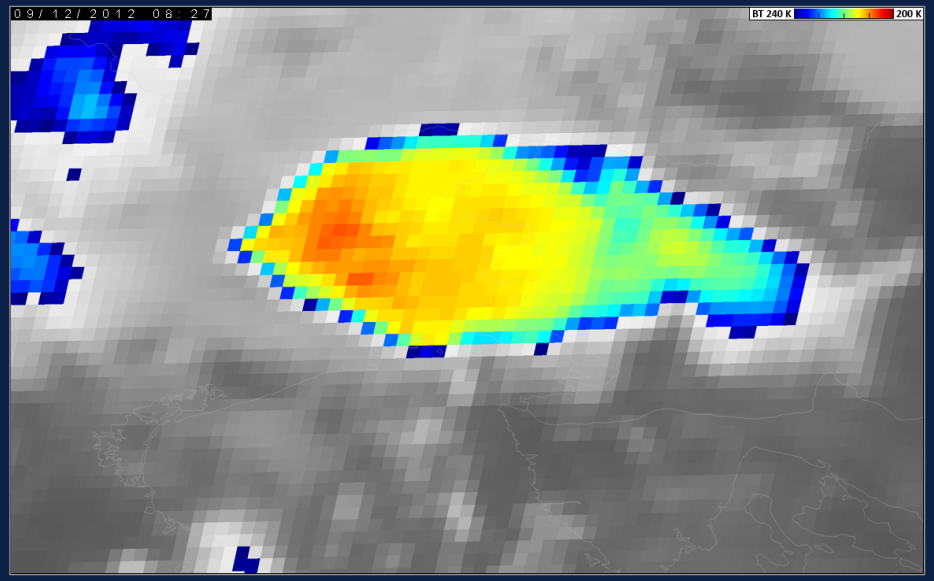


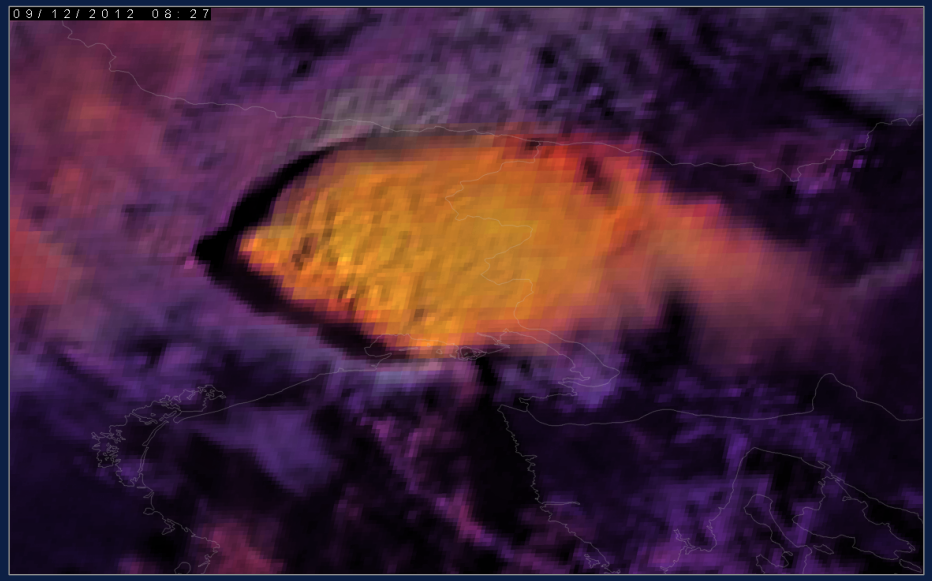


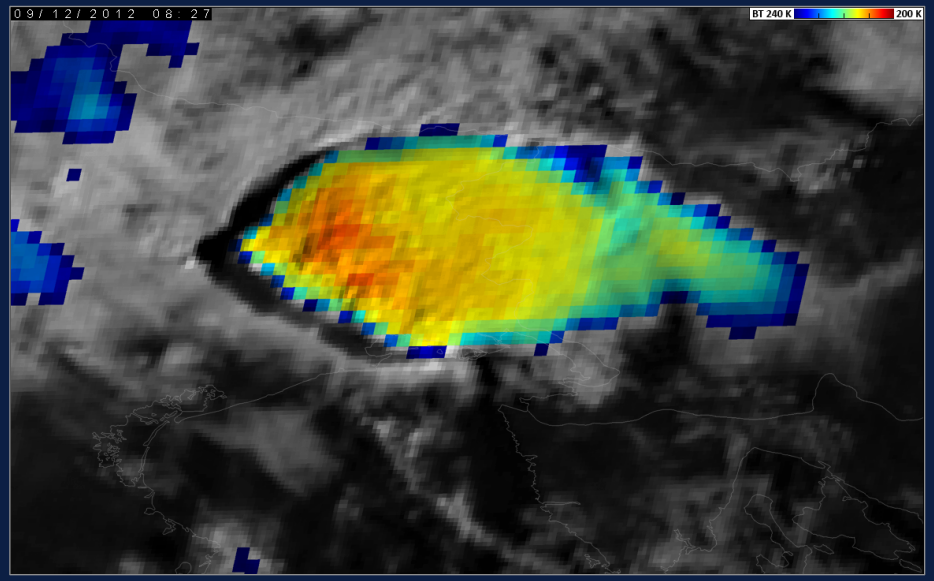


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

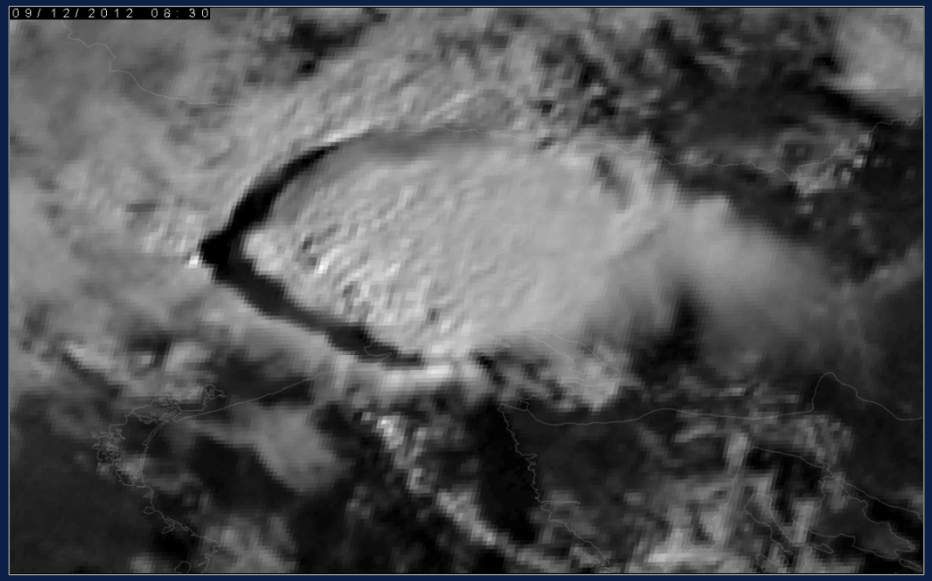


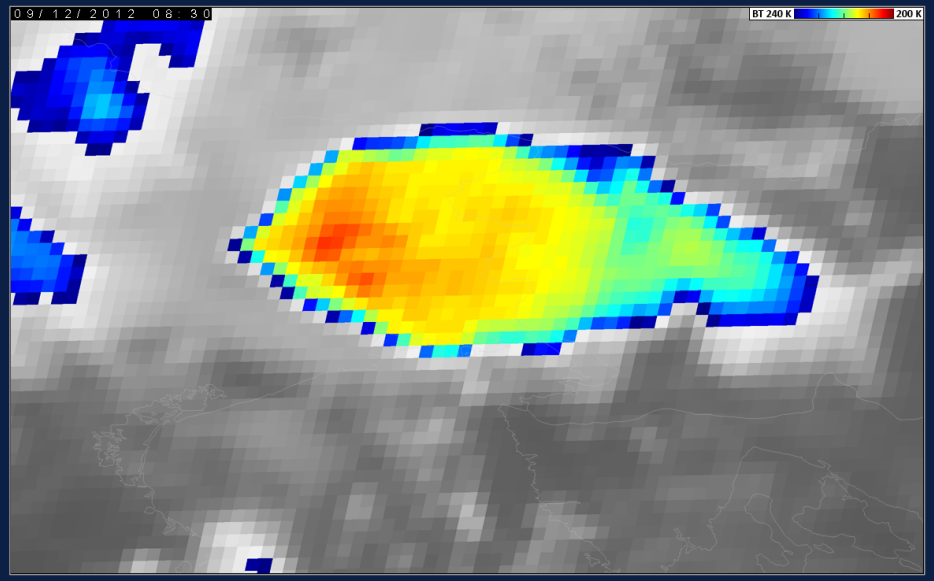


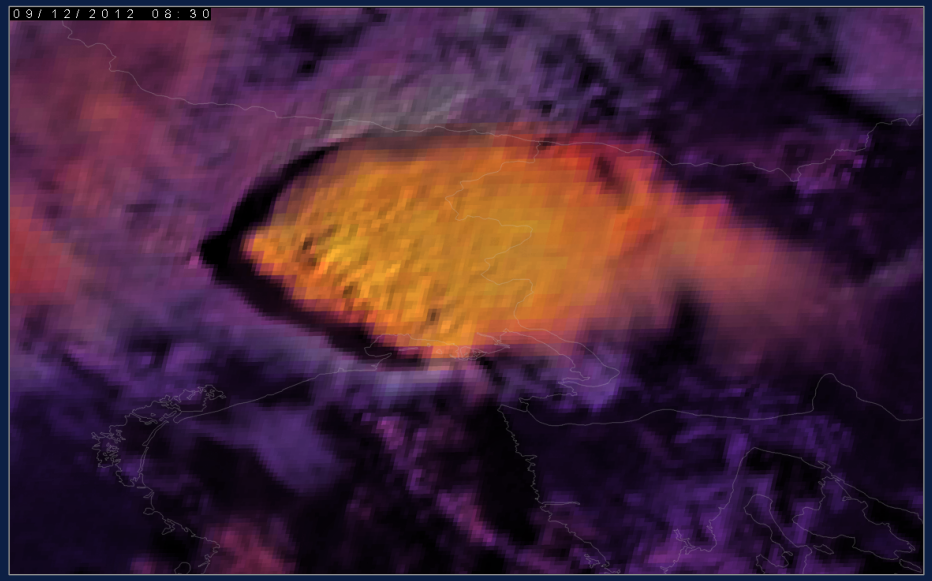


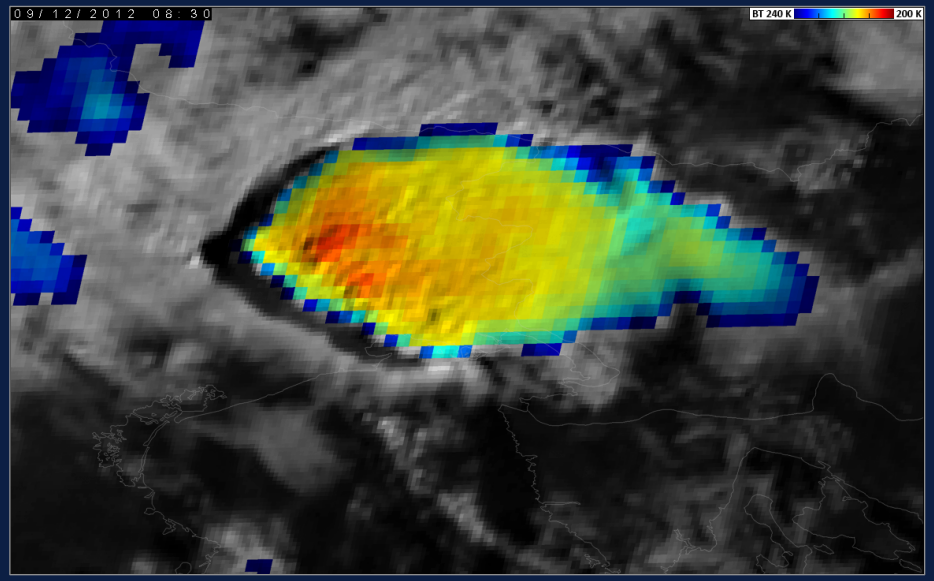


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

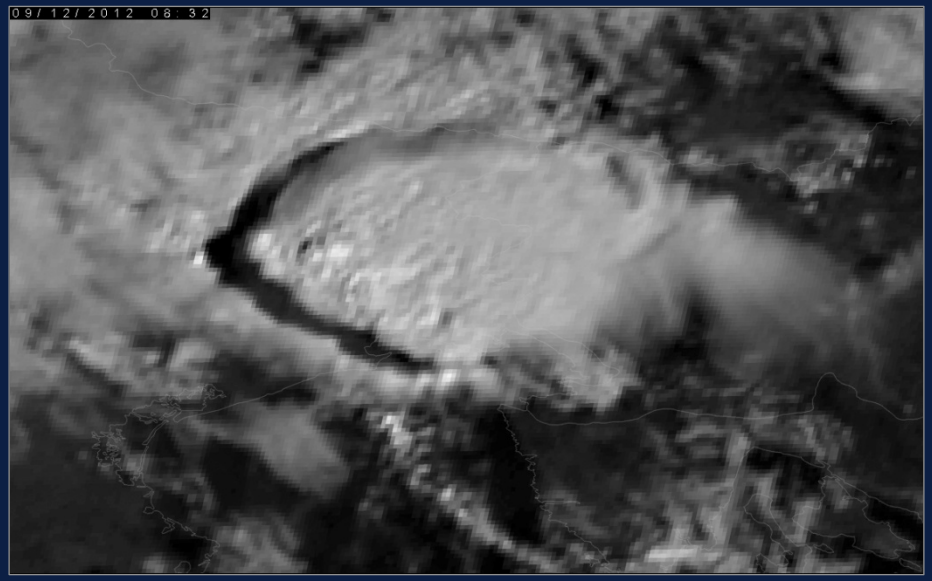


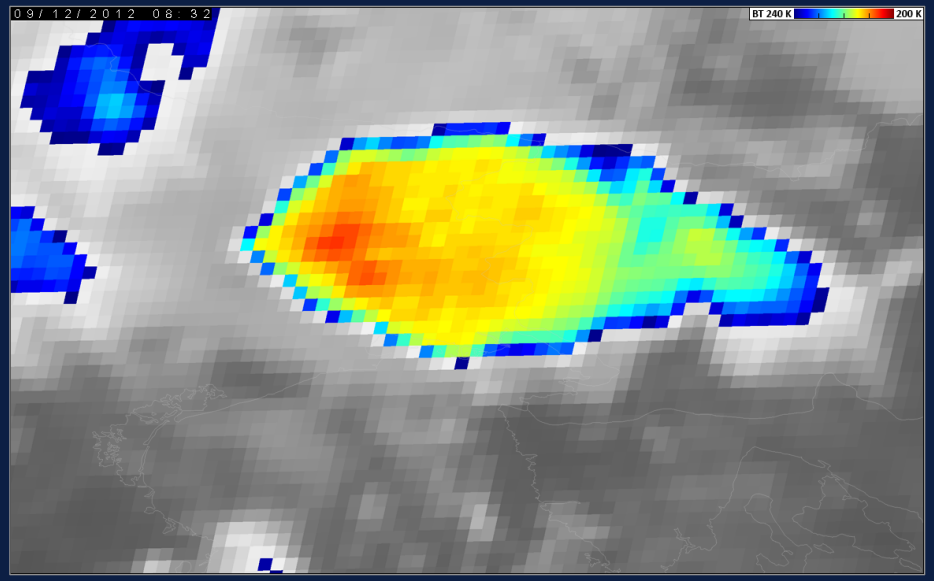


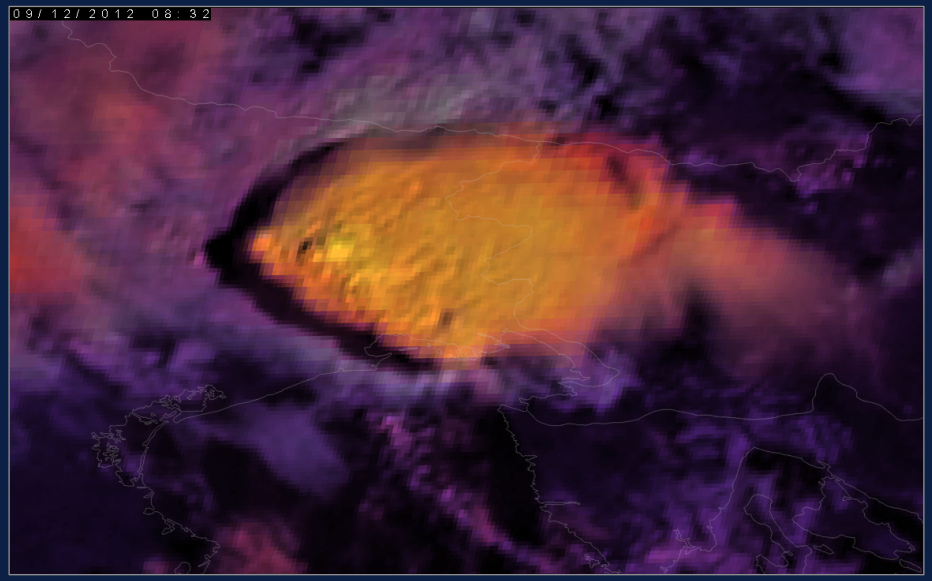


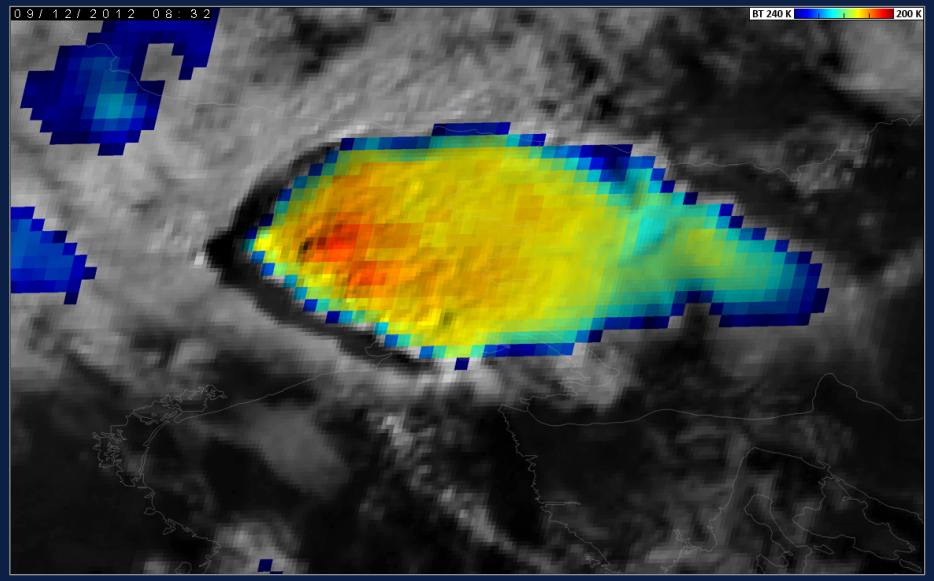


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

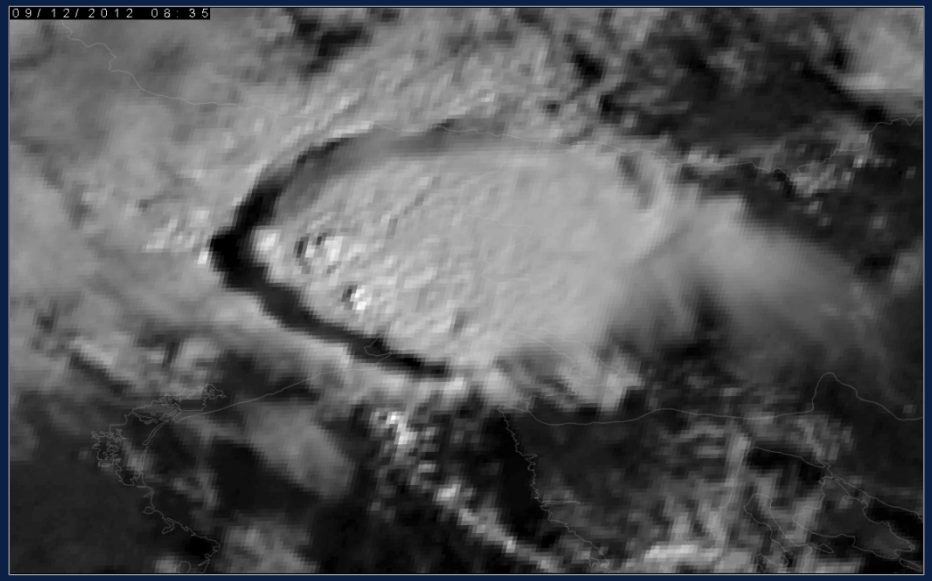


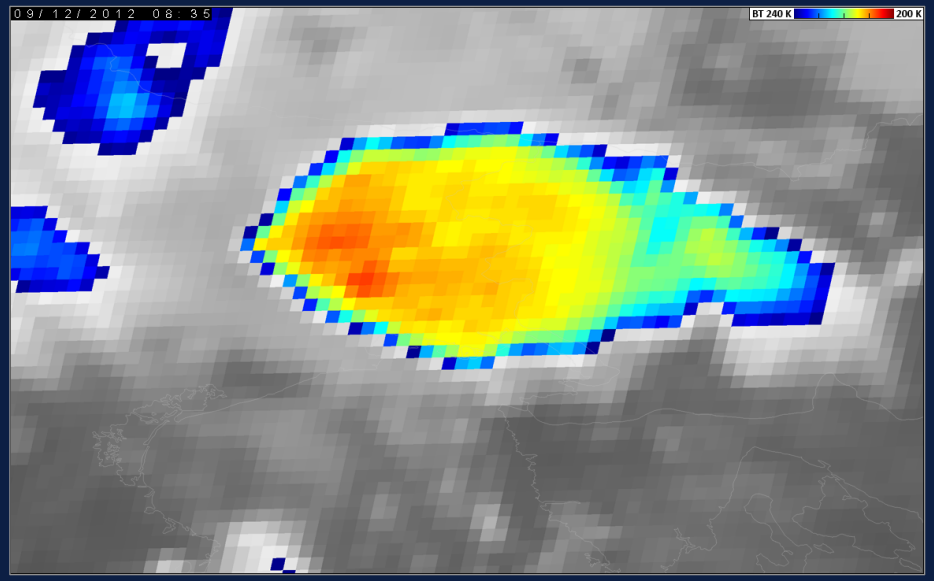


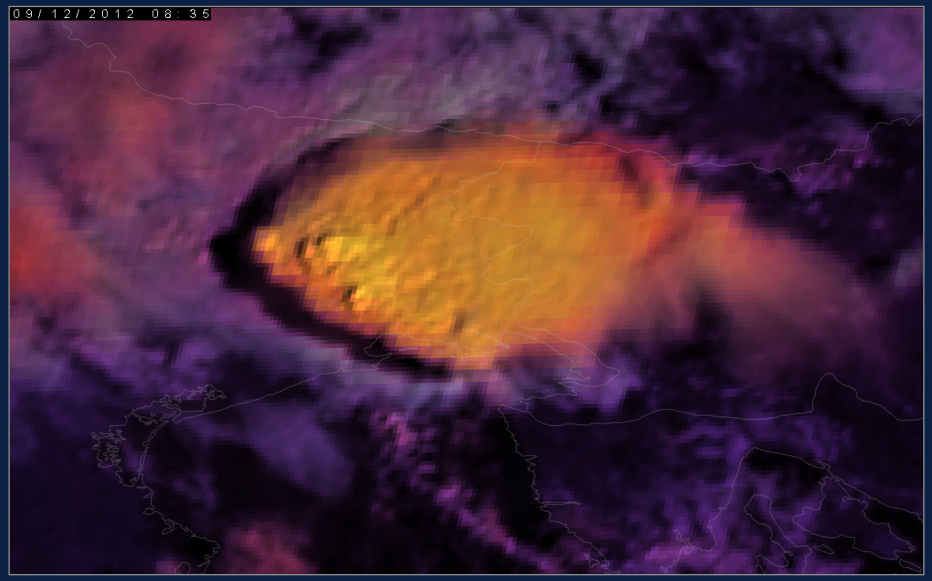


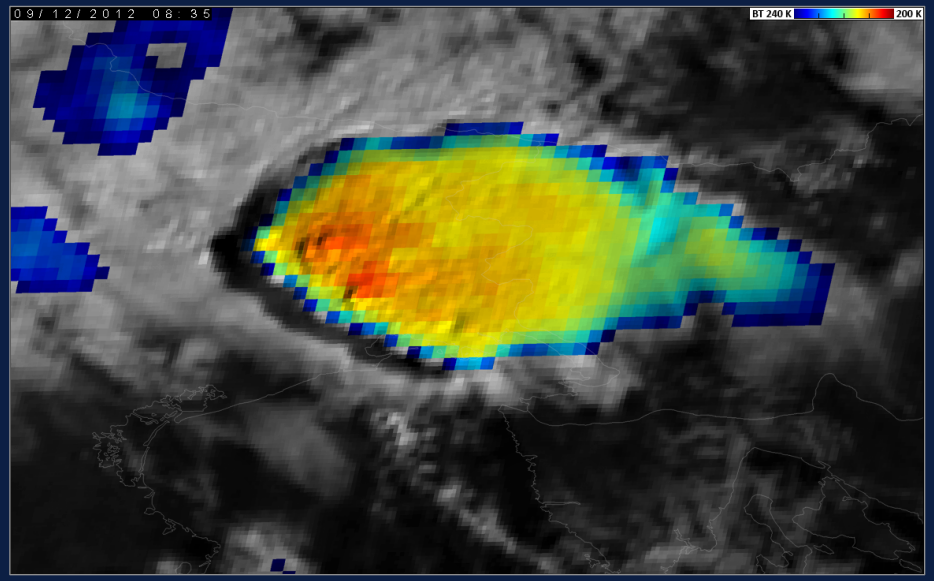


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

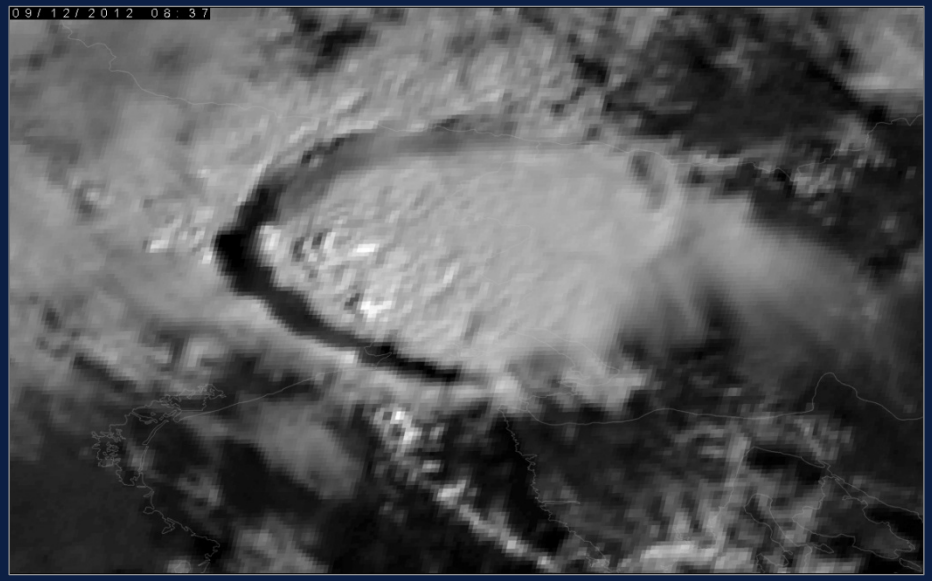


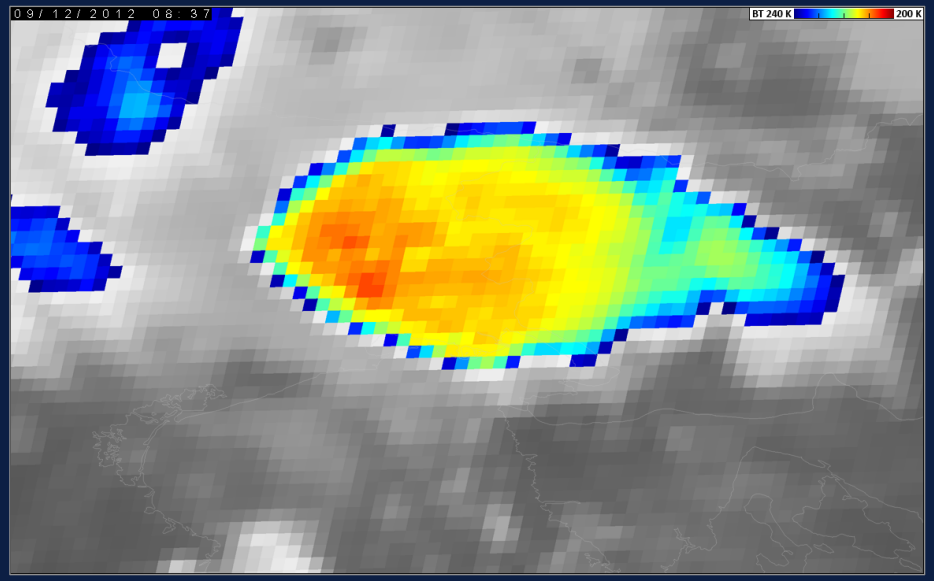


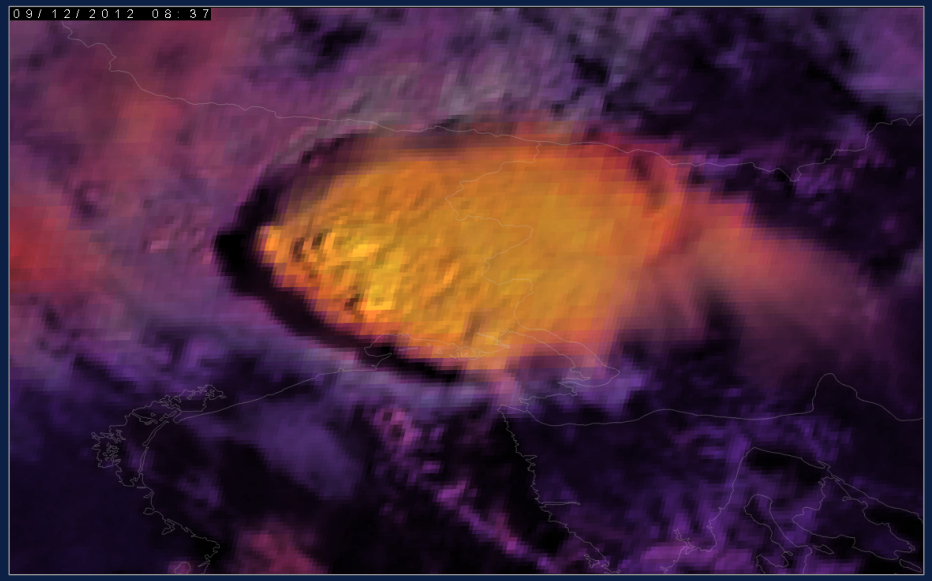


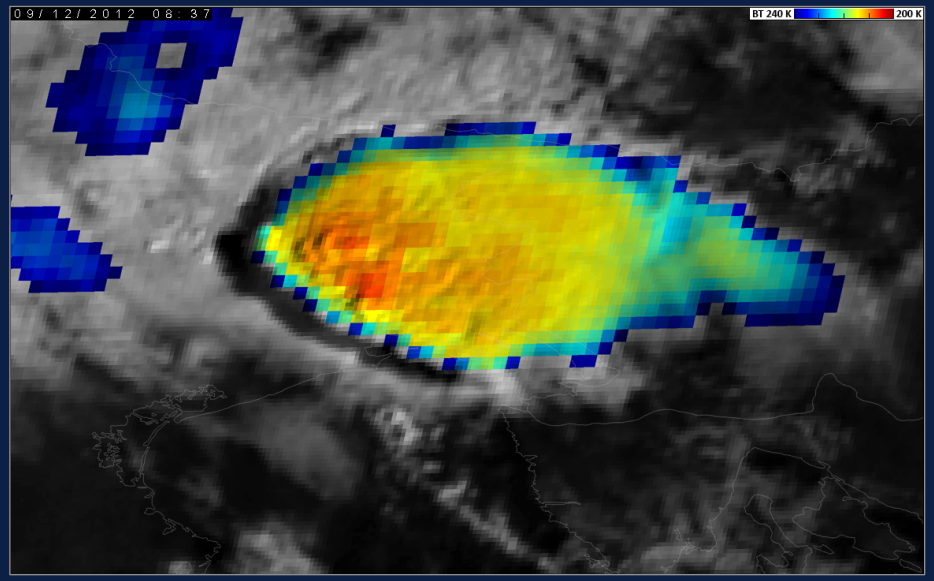


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

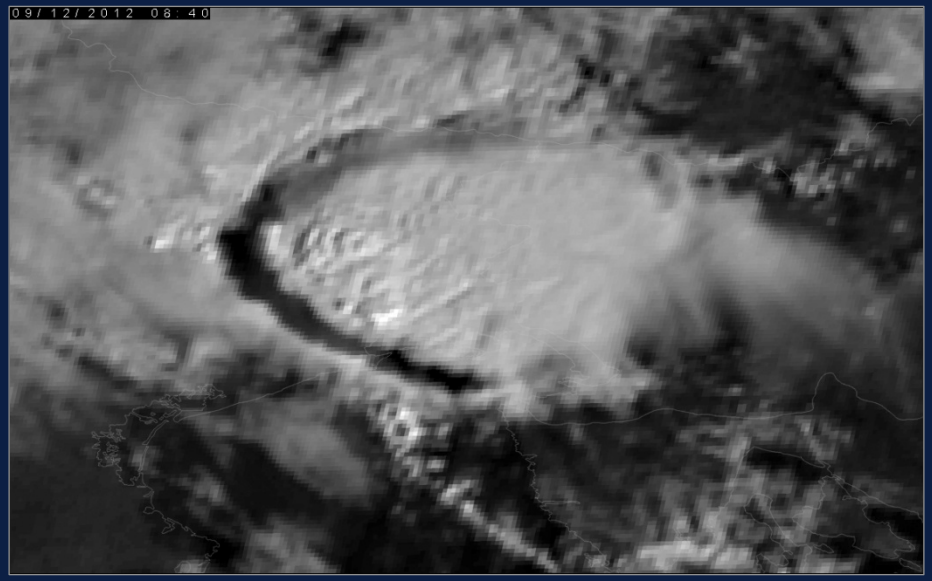


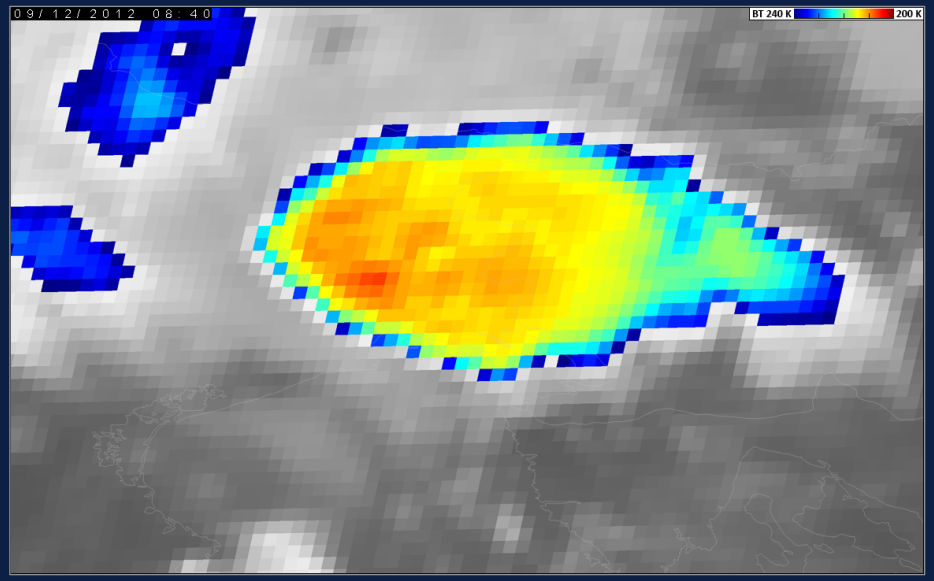


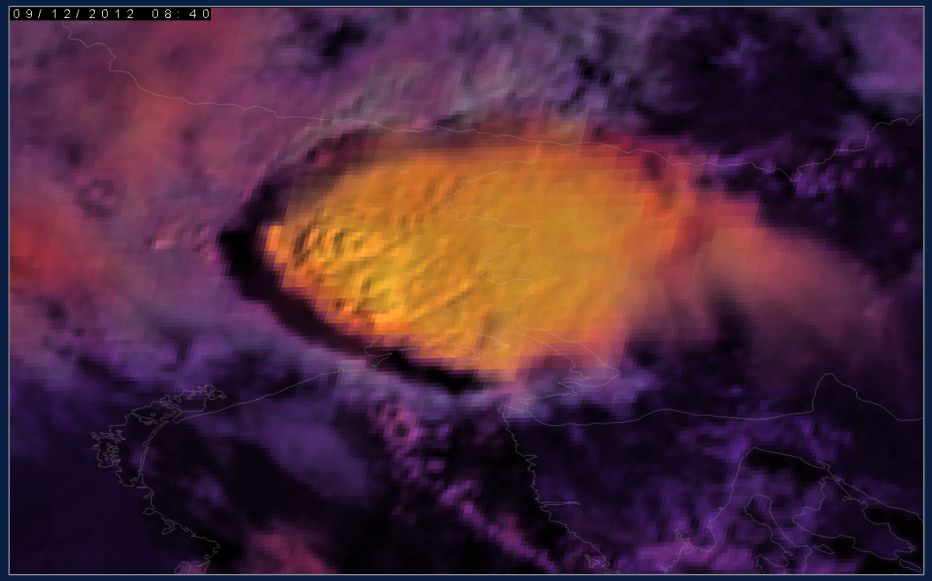


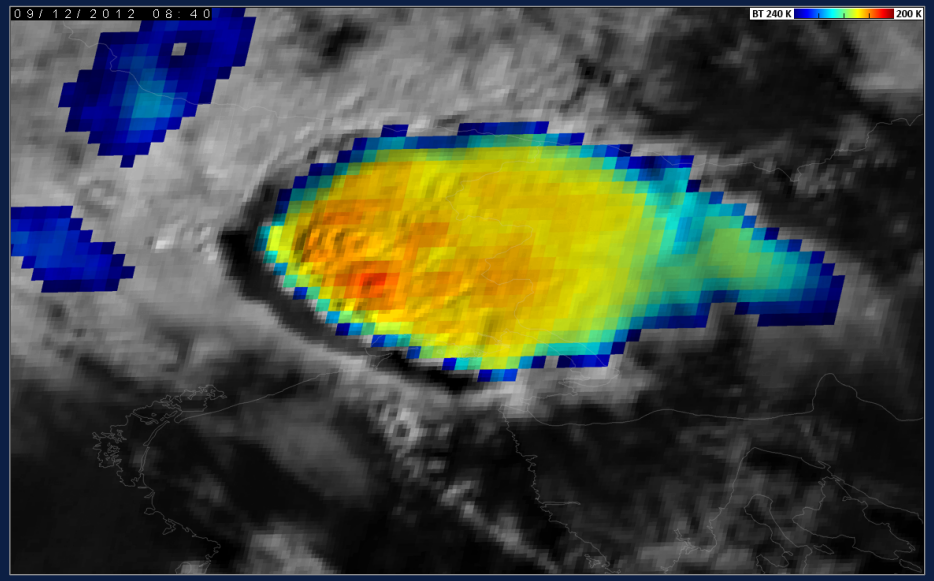


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

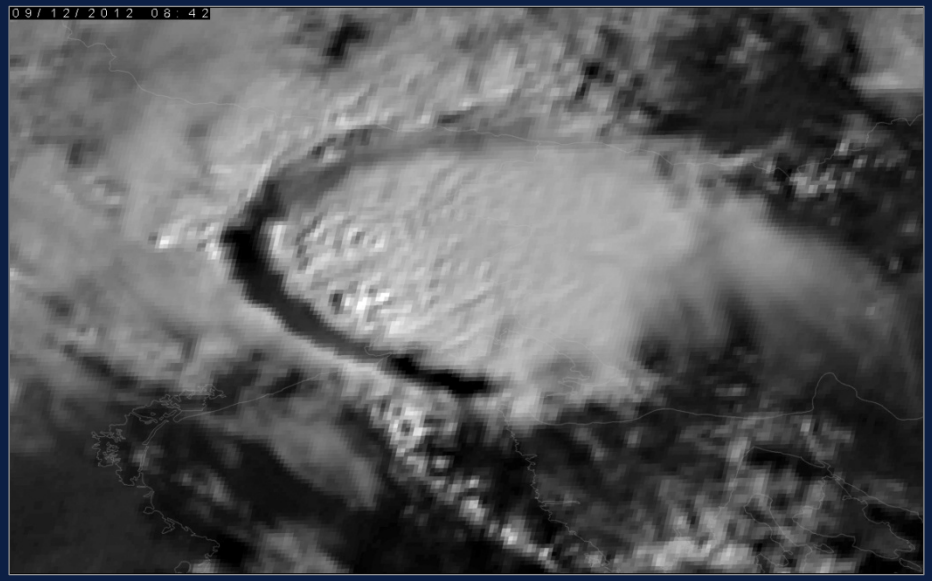


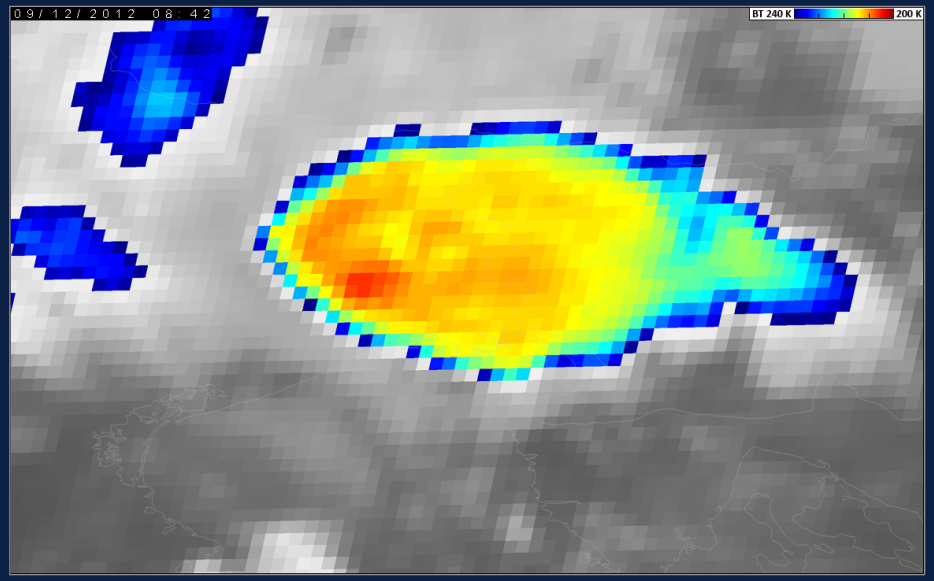


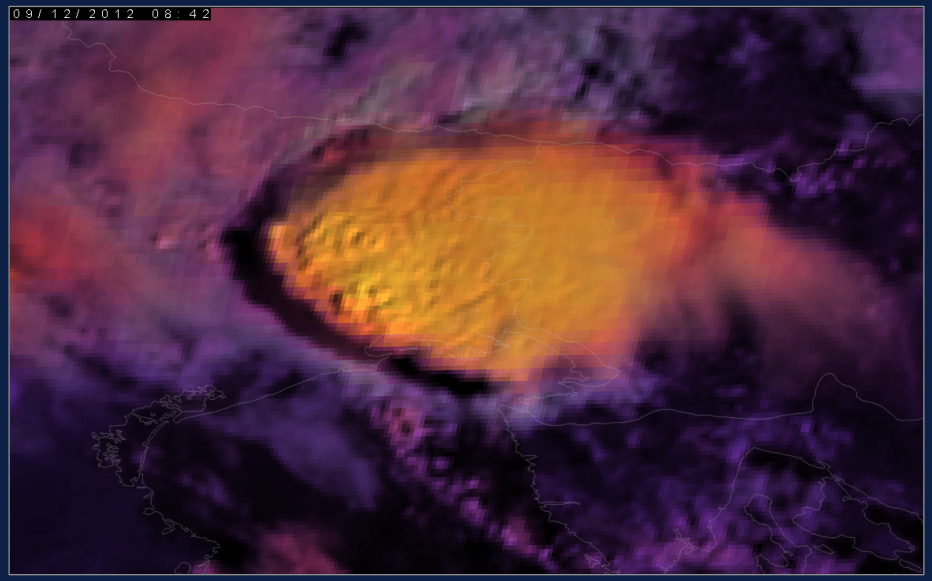


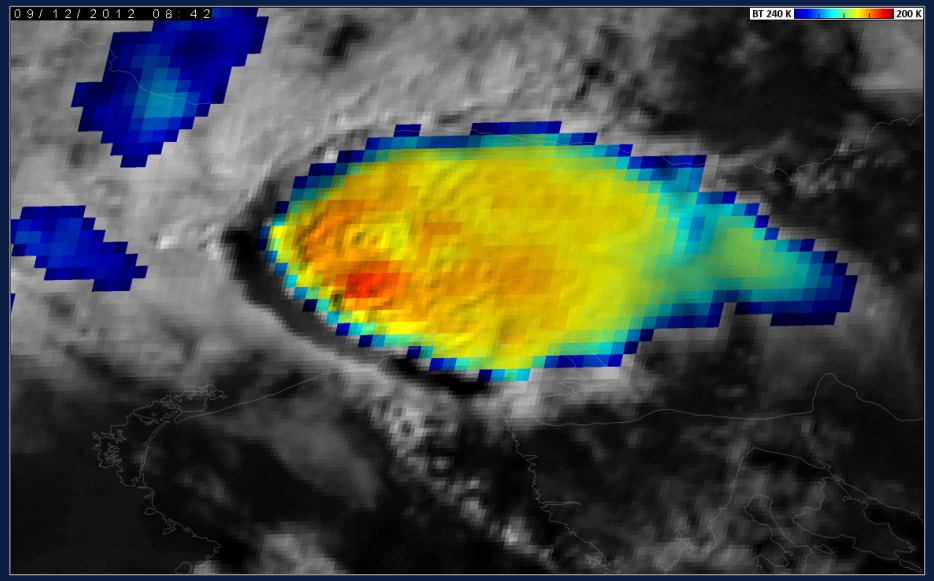


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

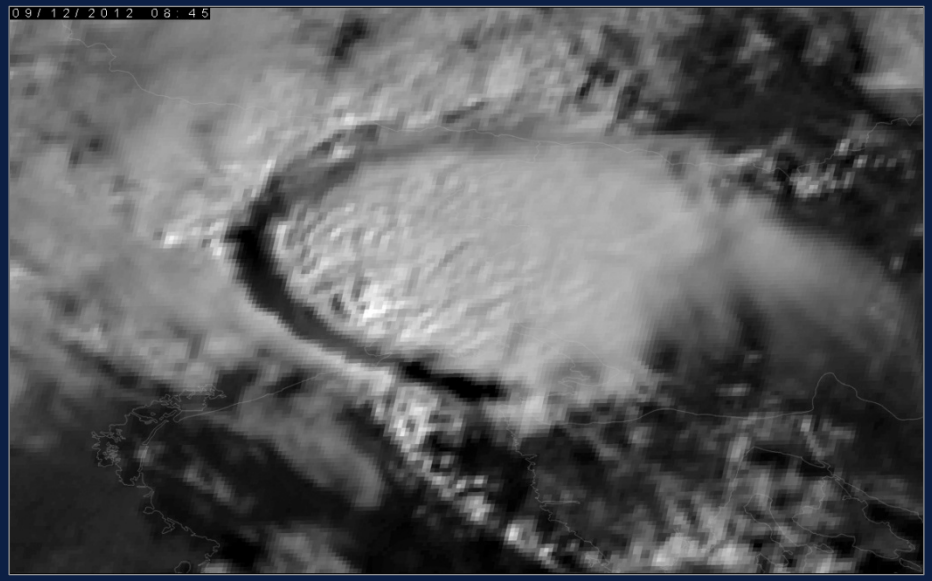


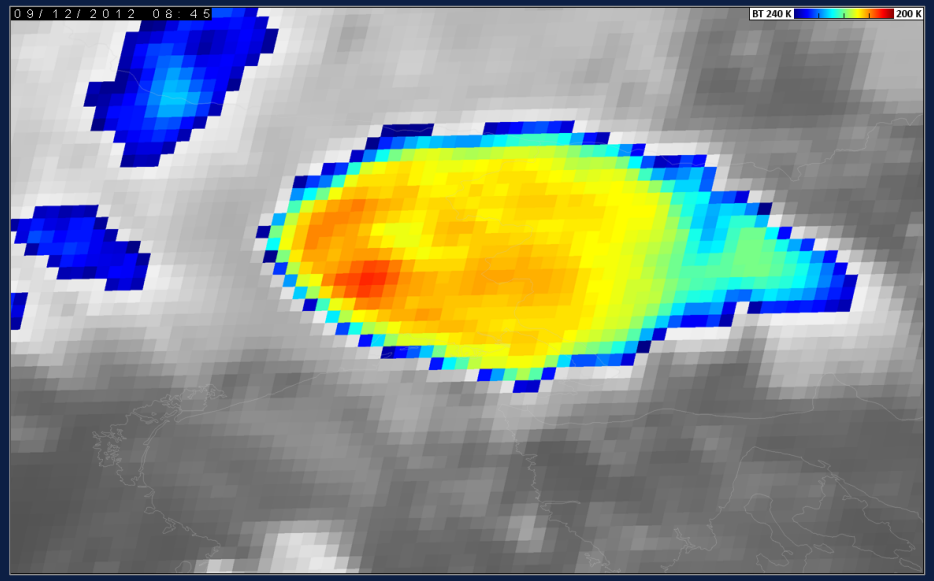


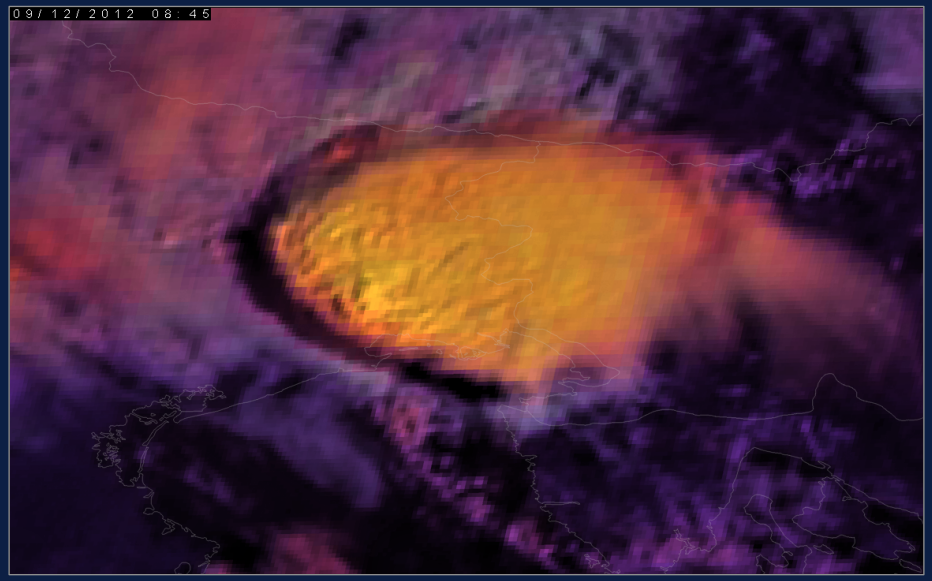


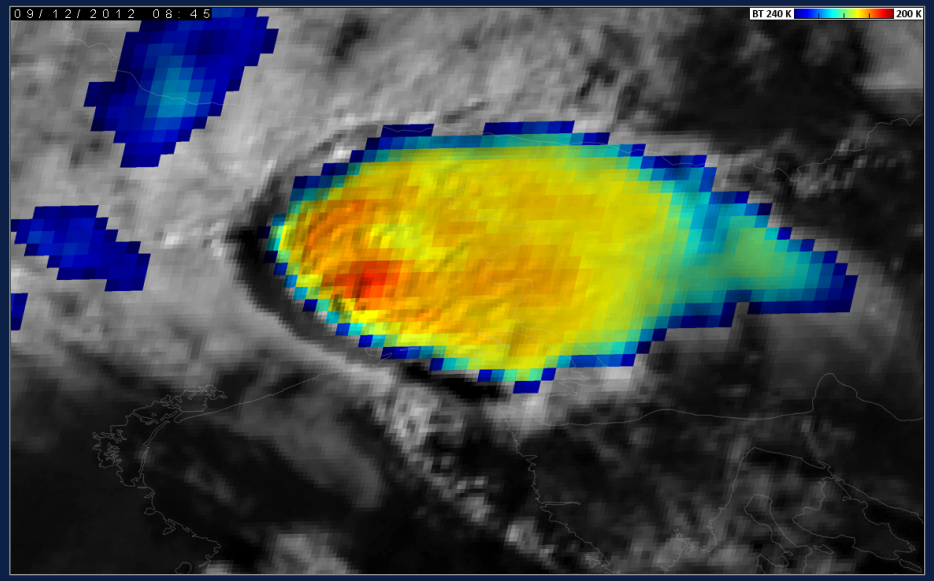


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

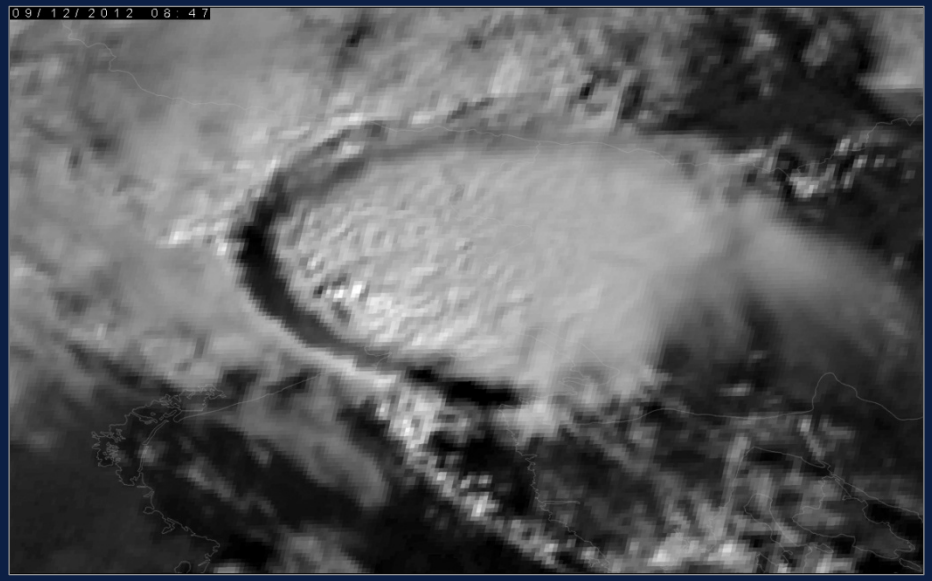


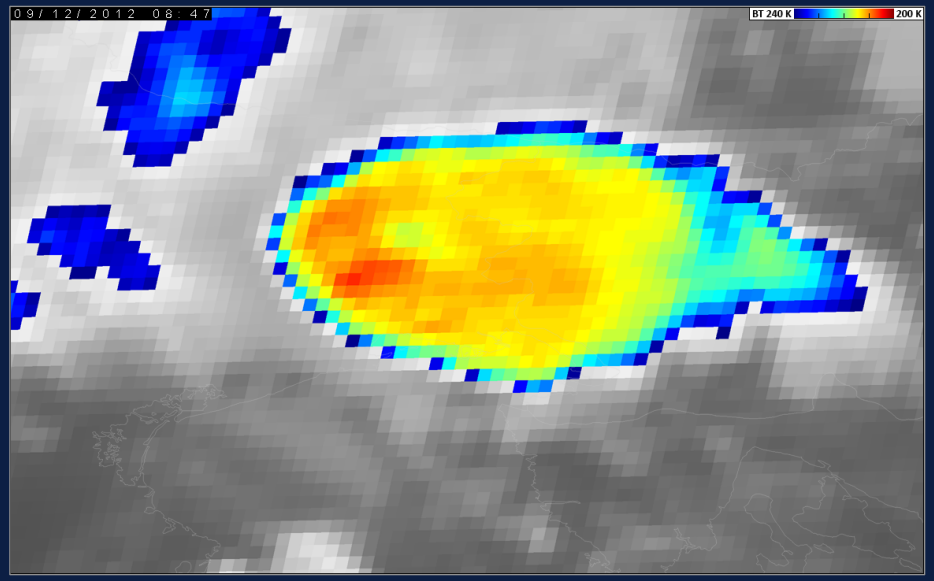


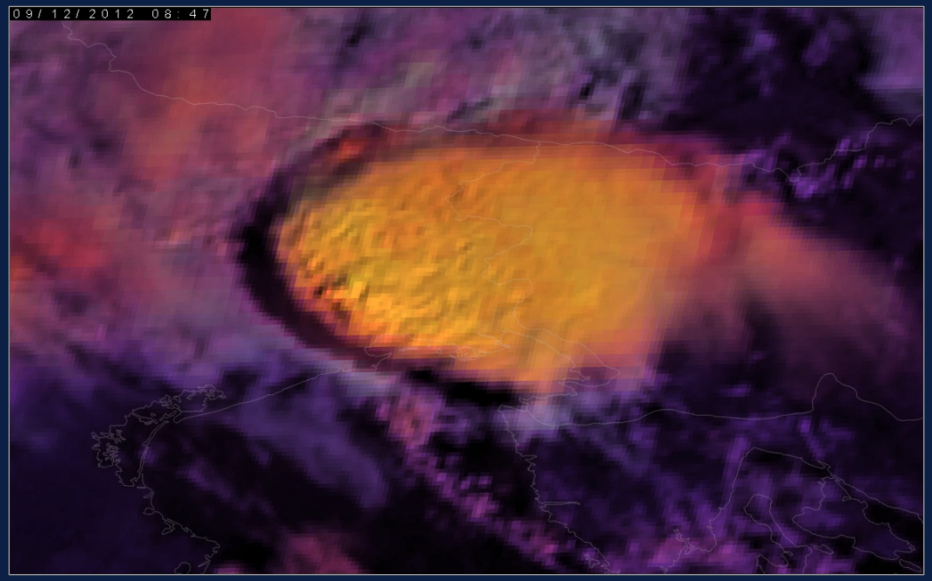


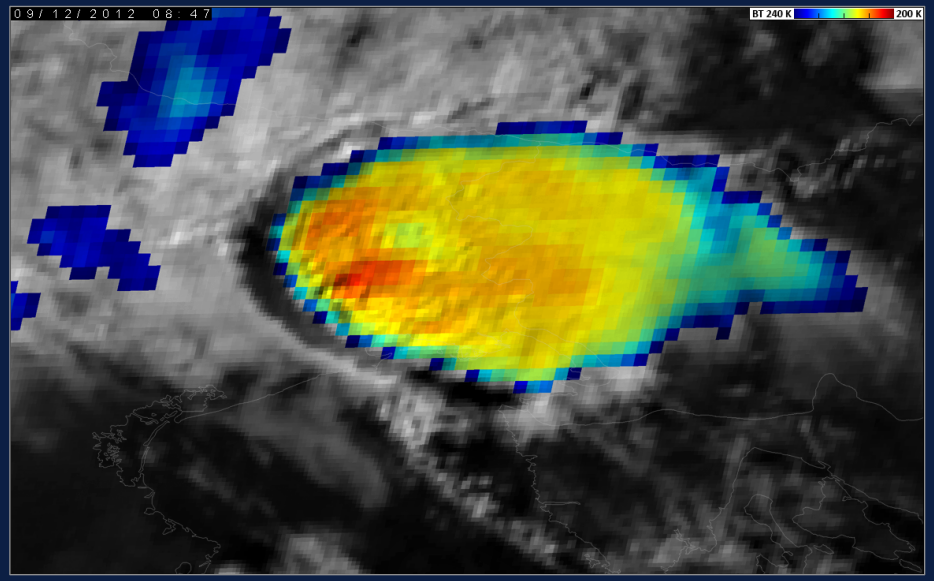


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

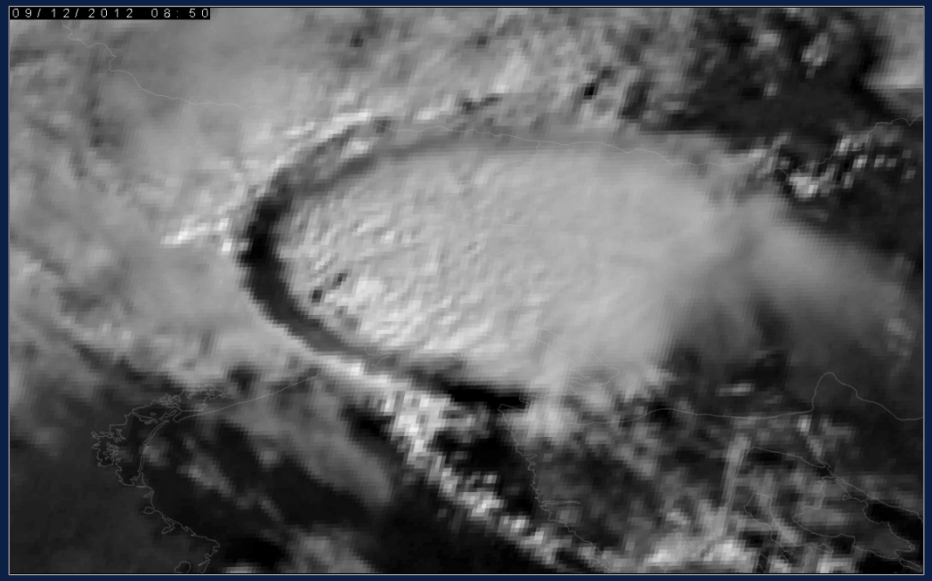


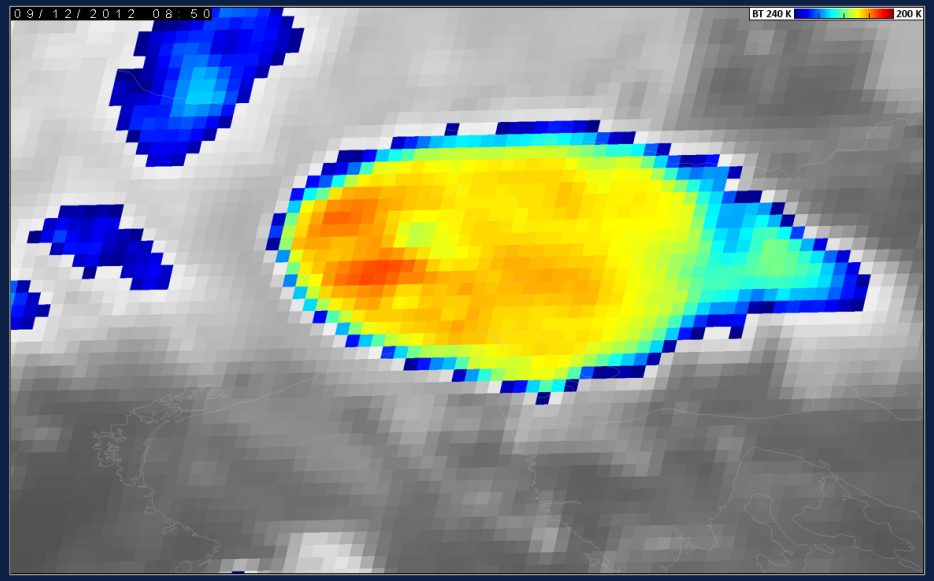


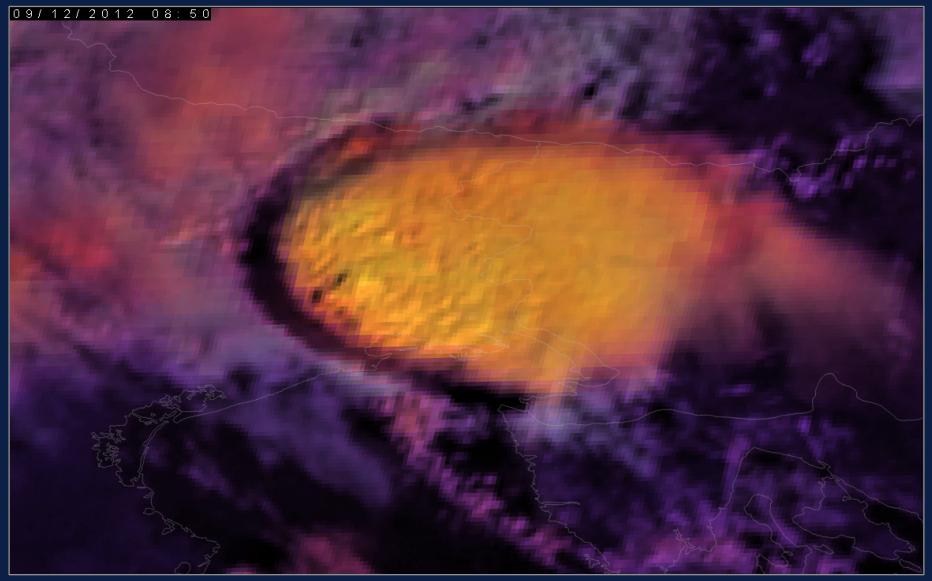


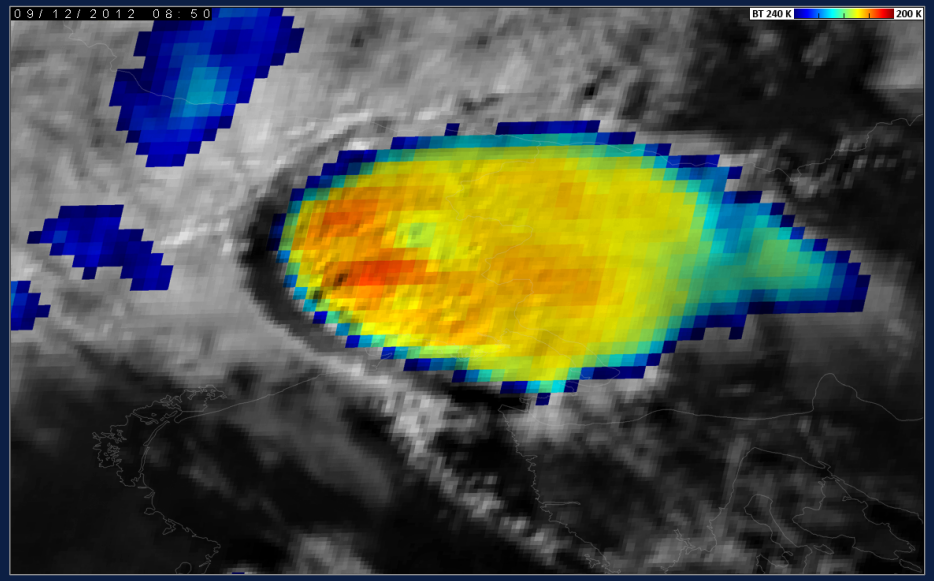


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

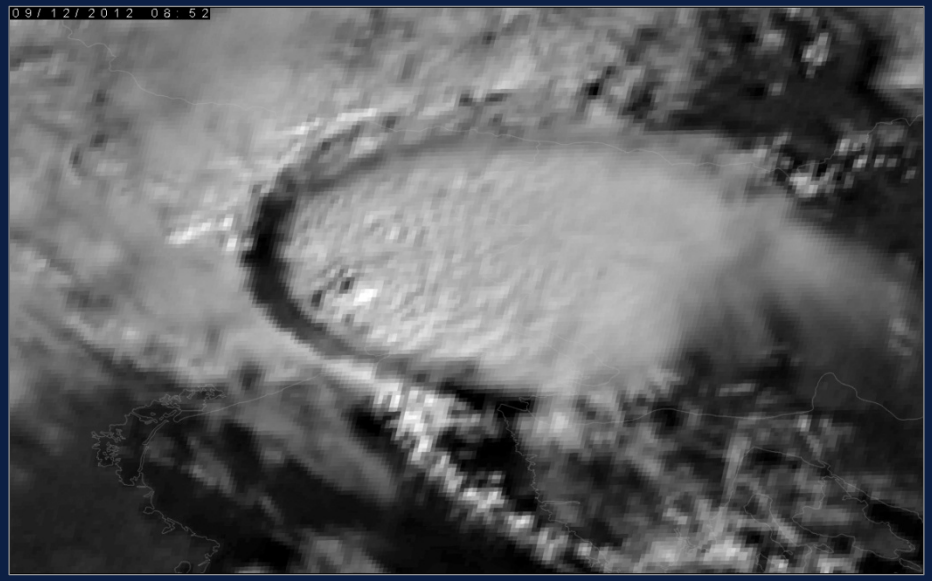


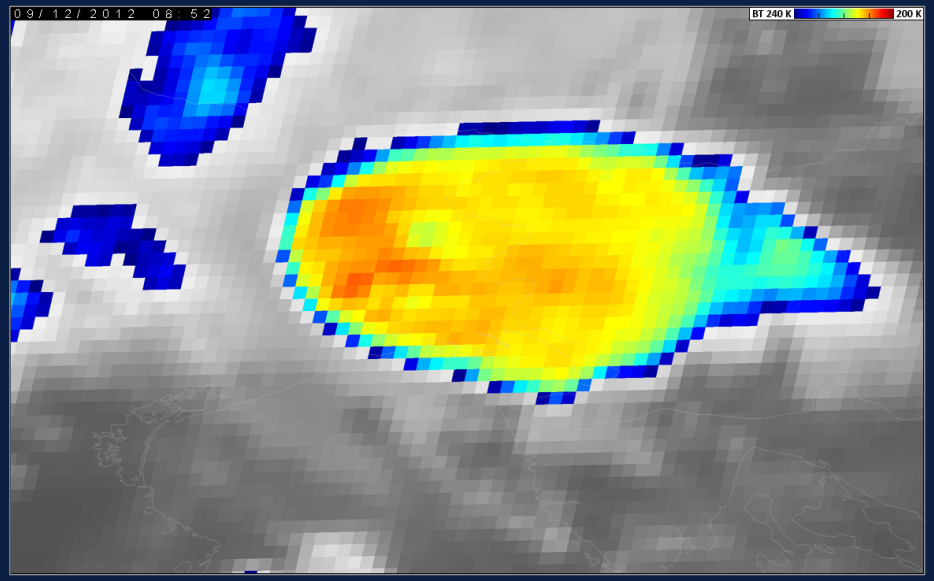


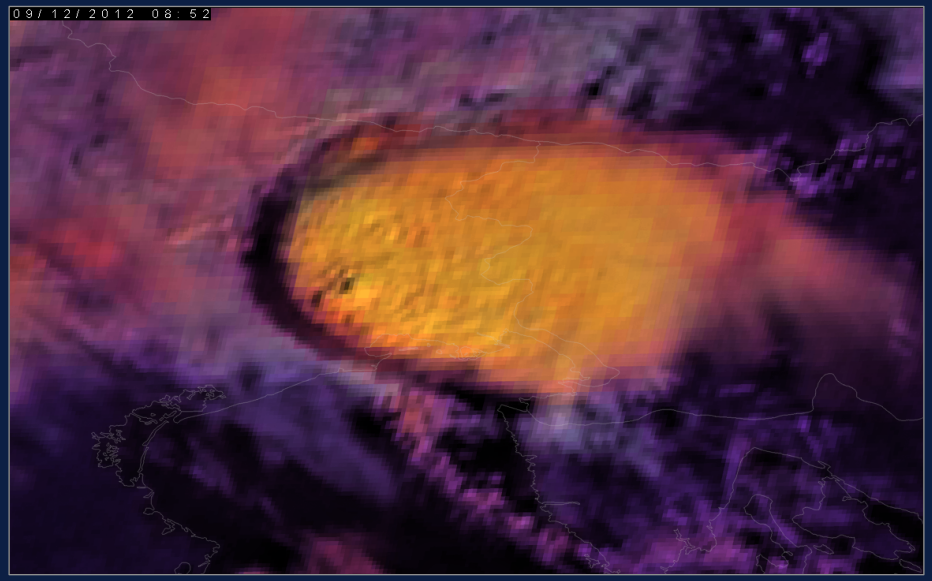


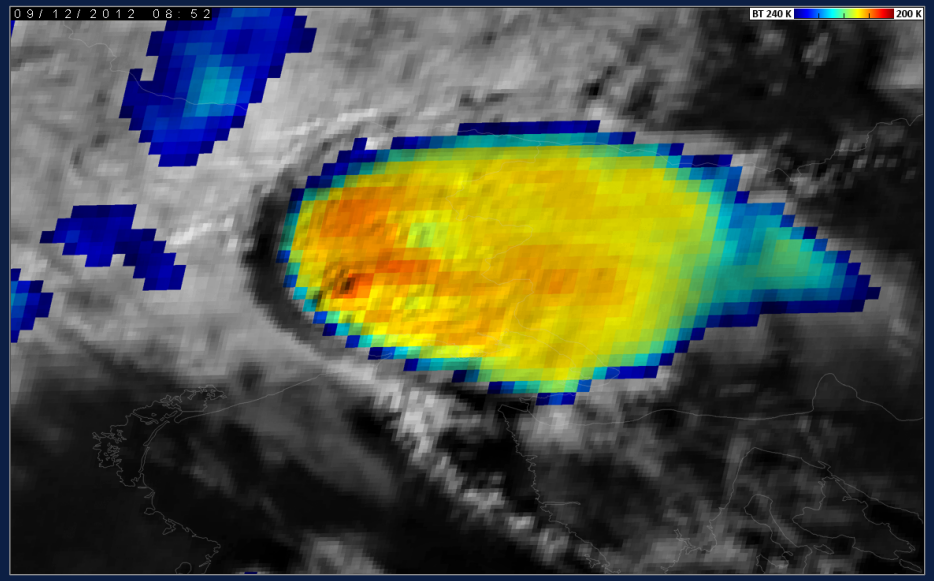


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)

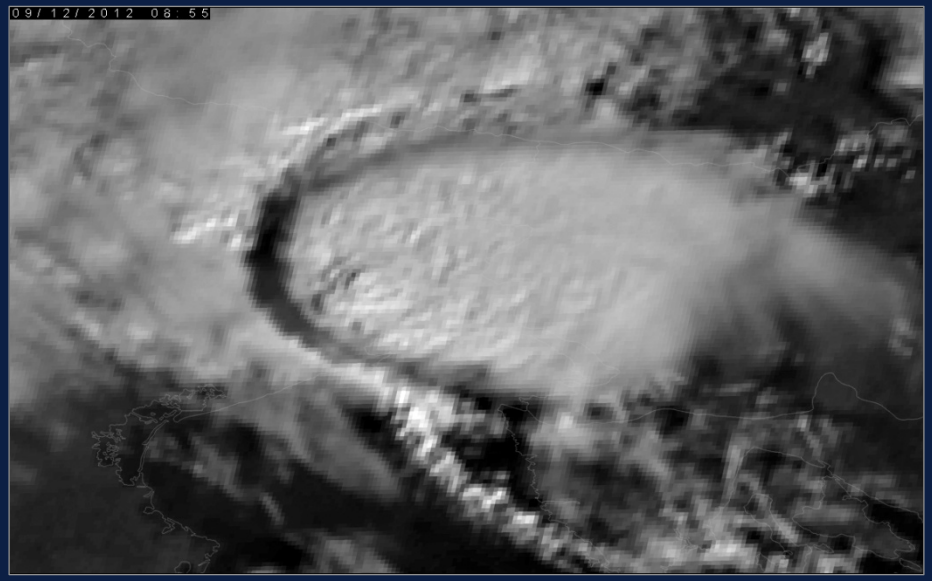


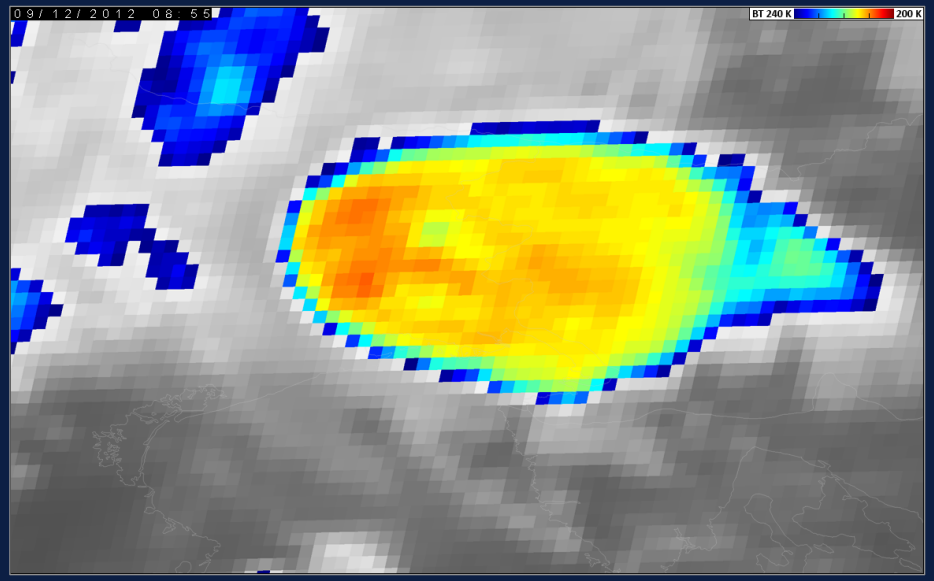


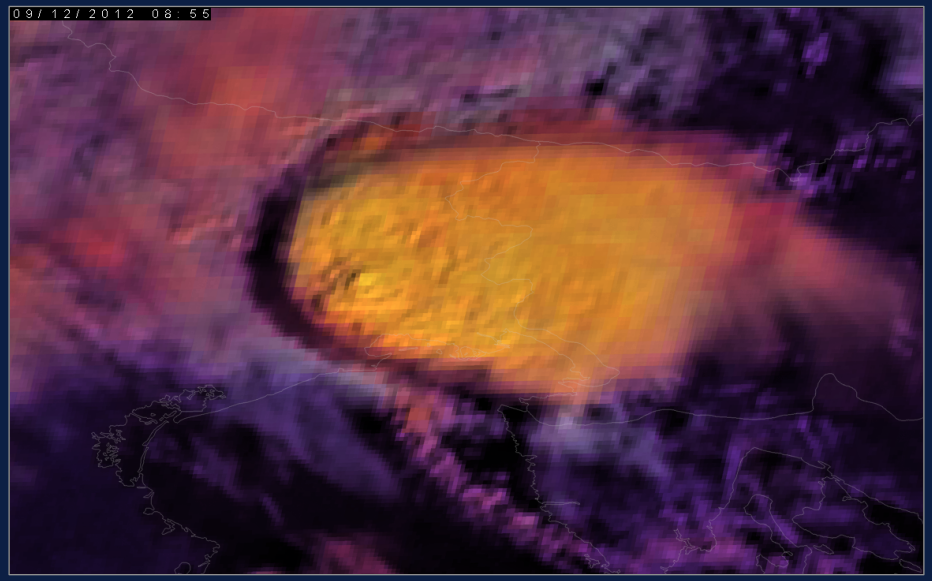


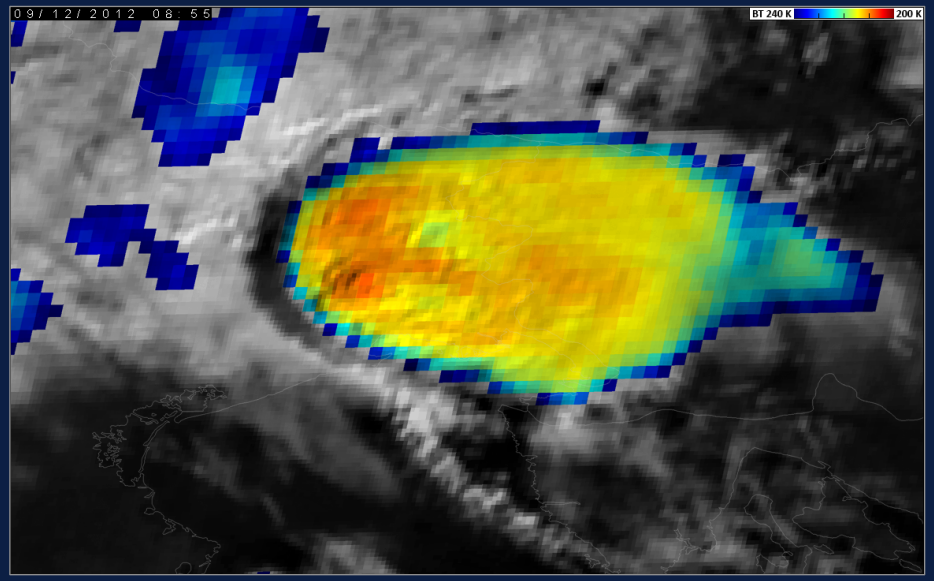


Storms over northeast Italy – storm top details (08:20 – 08:55 UTC)









Final comments (1)

- The first 2.5-minute rapid scan experiment with Meteosat-10, despite the late time of the year from the perspective of convective storms, has confirmed the significant temporal variability of features observed at tops of convective storms, namely the overshooting tops.

- For weaker storms (such as those over Austria), the life cycle of the overshooting tops seems to be somewhere from less than 5 minutes, up to about 10 minutes, and most of these overshooting tops don't seem to be associated with coldest pixels (these can be found elsewhere within the storm top, not linked to the overshooting tops).

- For stronger storms (such as those over northeast Italy), the overshooting tops seem to either live somewhat longer, or re-occur quickly at the same or very close locations. These seem to be much closer linked to the coldest areas as compared to the weaker case above.

Final comments (2)

- The 2.5-minute rapid scan test with MSG-3 has confirmed the usefulness of this scanning frequency for future operational monitoring of convective storms, planned for MTG. With the present MSG 5-minute rapid scan service, some of the overshooting tops may either escape their detection entirely, or can be captured first already at their decaying phase (thus at higher BT). This can be significant for various nowcasting applications, based on automatic OT detection techniques.

- A collaboration on this topic with the U.S. colleagues is highly desirable due to their access to 1-minute data from the present GOES satellites. Advantage of the MSG 2.5-minute rapid scan is in its better SEVIRI instrument, while significance of the GOES satellites is in their shorter sampling frequency.

Final comments (3)

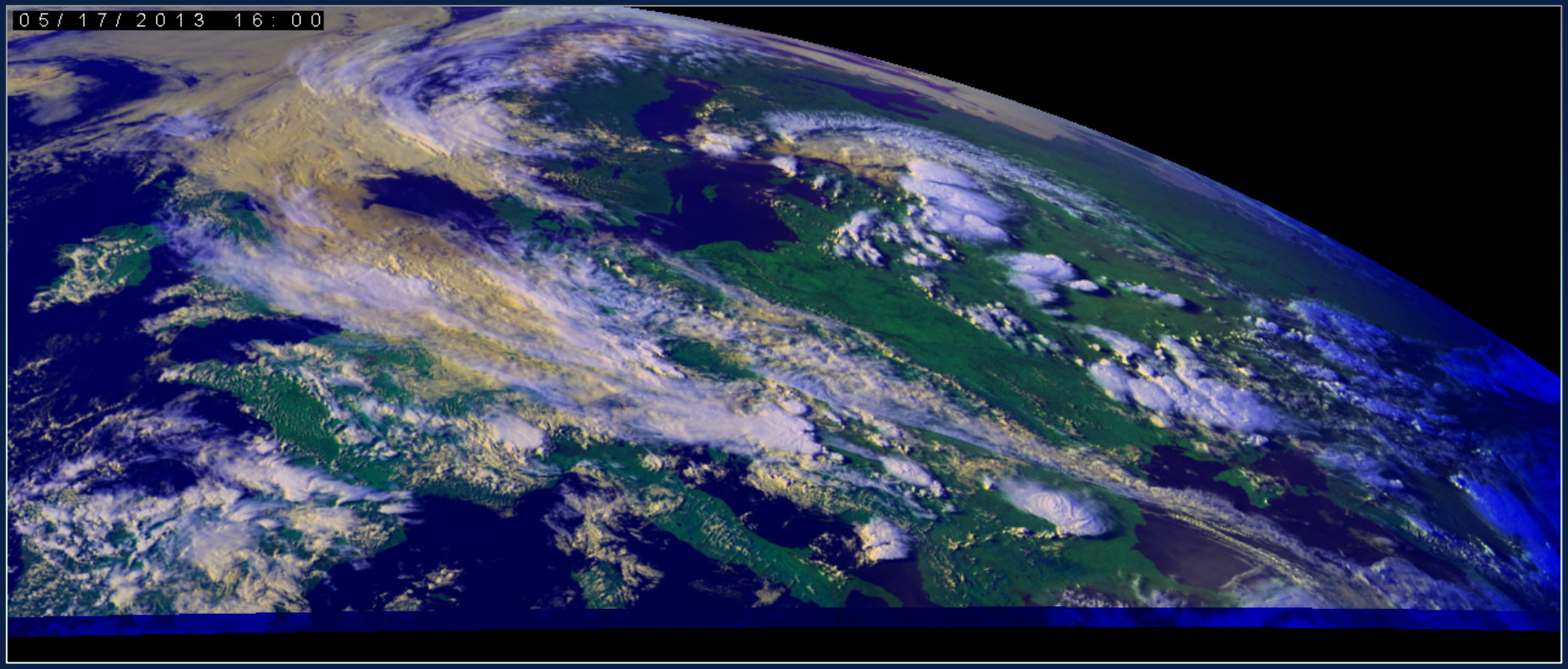
- Based on the Meteosat-10 (MSG-1) experiment, it was decided to repeat similar 2.5-minute rapid scan experiments with Meteosat-8 (MSG-1) during high convective season of 2013, to obtain datasets capturing well-developed severe convective storms.

- As similar permanent service is not possible, the 2.5-minute rapid scan will be activated for total of four 12-hour periods only, timing of these to be based on consultations with forecasters;

- the decision about recommending favorable days was delegated to ESSL.

- First of these Meteosat-8 2.5-minute rapid scan sessions was carried out on 17 May 2013 (09-21 UTC).

2.5-minute rapid scan with Meteosat-8, session #1, 17 May 2013



Overview of the case: RGB129 (MOV or MP4)

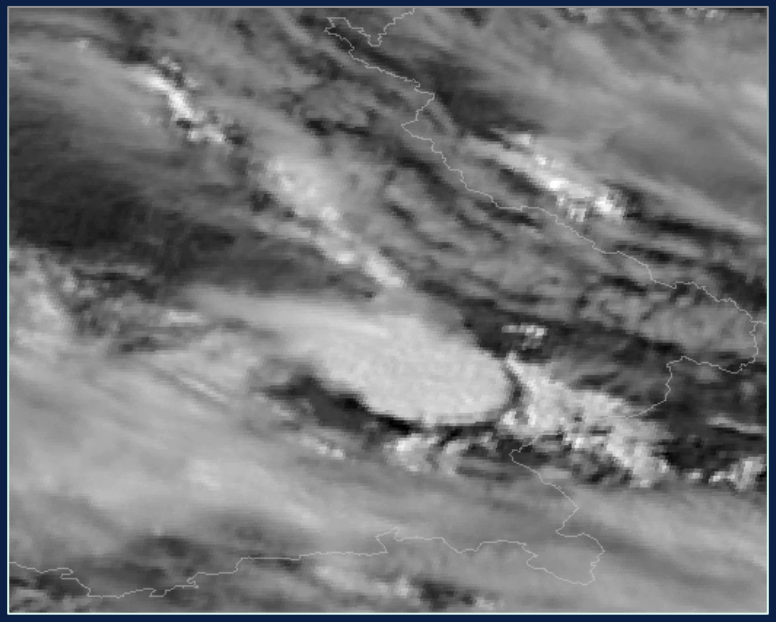
Data (HRIT and NATIVE formats) available at:

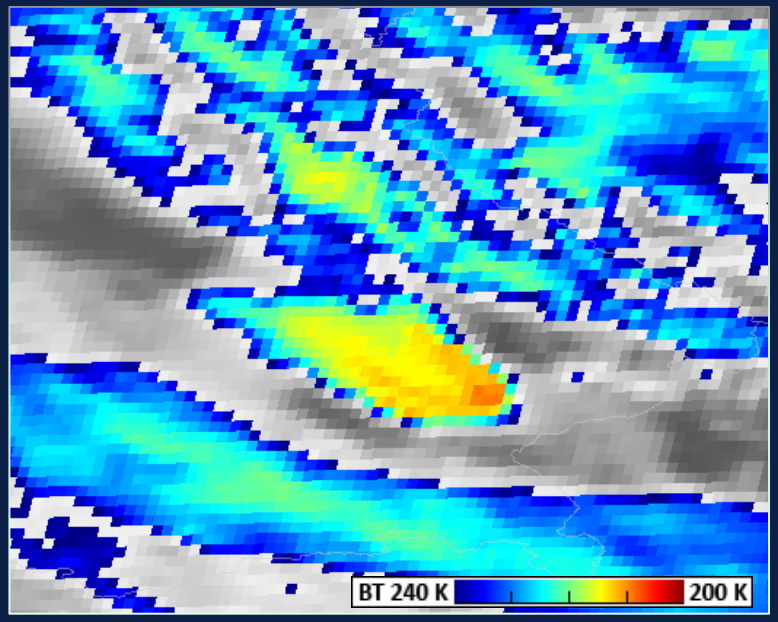
ftp.eumetsat.int/pub/EUM/out/OPS/User/2.5-min_scan_17May2013/

2.5-minute rapid scan with Meteosat-8, session #1, 17 May 2013 13:32 UTC

HRV

loop
MOV MP4



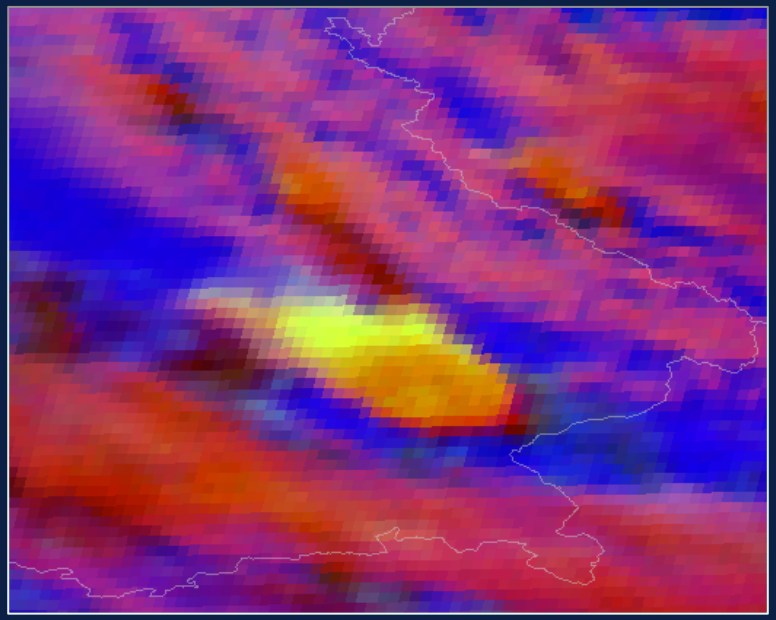


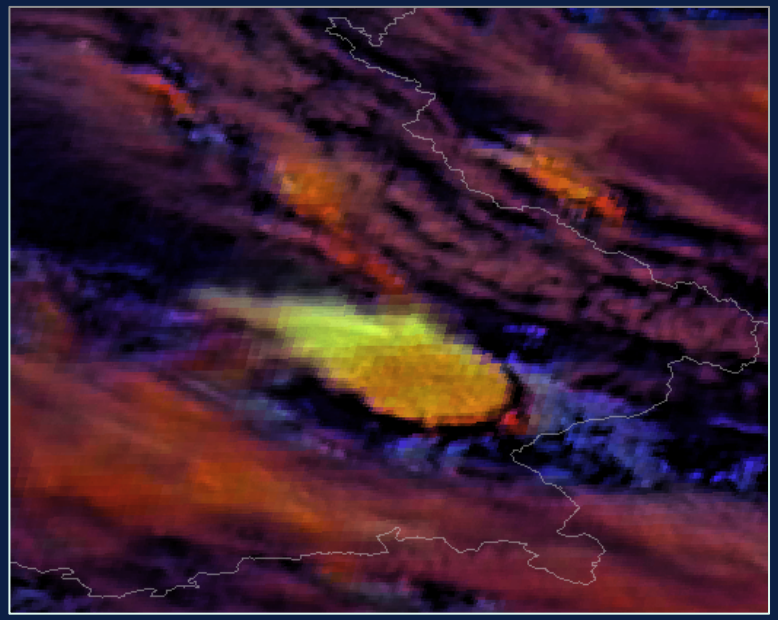
IR10.8 BT
200-240K

loop
MOV MP4

Storm RGB

loop
MOV MP4





Sandwich HRV
& Storm RGB

2.5-minute rapid scan ...

More information, movies and links to the collected data (also for the three remaining 2.5-minute Meteosat-8 rapid scan sessions) at the Convection Working Group (CWG) website:

http://essl.org/cwg/

Thank you for your attention!