

# DRIHM

DISTRIBUTED RESEARCH INFRASTRUCTURE  
FOR HYDRO-METEOROLOGY

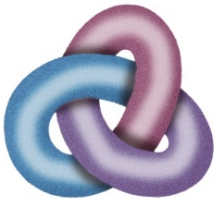
## DRIHM for Citizen Scientists

Arnold Tafferner, Caroline Forster (DLR)



advancing the frontiers



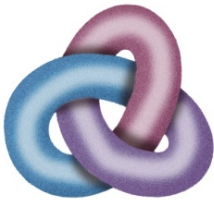


James Doherty (ISGTW - International Science Grid This Week, March 12 , 2014):

- Citizen science is scientific research conducted in whole or part by amateur or non-professional scientists.
- There is a spectrum of different kinds of citizen science from 'crowdsourcing', in which citizens analyze data, to 'extreme citizen science', where scientists collaborate with citizens in problem definition, data collection and analysis.
- Computers, mobile phones, and other devices are helping to mobilize the citizen science community.
- Citizen science is no passing fad but a movement on the forefront of a fundamental shift in how we approach science and education.

With regard to **DRIHM** the DLR thunderstorm tracking and monitoring system **Cb-TRAM** has been ingested into the DRIHM platform that allows citizen scientist users to experiment with certain pre-prepared scenarios.

This DRIHM service gives a sense to the citizen scientist of the more advanced nowcasting tools available



## Cb-TRAM web application for citizen scientists

Drihm portal

portal.drihm.eu/cbtram/

Meistbesucht Erste Schritte DLR Webpostkorb Vorgeschlagene Sites Web Slice-Katalog

### DLR - DRIHM - Cb-TRAM

Temporal Selection

Please note that it takes approximately 2 minutes to calculate one hour of Cb-TRAM results

Selected Date: 2011/10/25

Start Hour: 16 00 End Hour: 16 30

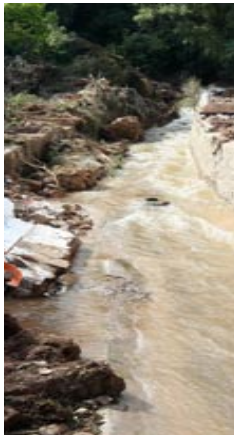
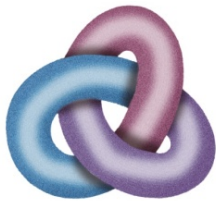
Map Selection

Select a spatial range using the mouse + SHIFT button.

Longitude Min: -9.988552 Latitude Min: 36.028011

Longitude Max: 21.775887 Latitude Max: 50.020237

Webportal and IDL Service  
Engine installation at DLR  
<http://portal.drihm.eu/cbtram/>



## Cb-TRAM web application for citizen scientists

**DLR - DRIHM - Cb-TRAM** - Mozilla Firefox

File Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

DLR - DRIHM - Cb-TRAM

extern04.pa.op.dlr.de

**DLR - DRIHM - Cb-TRAM**

Calculate

**Temporal Selection**

- 2010/06/22
- 2010/06/23
- 2010/06/24
- 2011/10/25
- 2011/10/27

France 27th and 28th October, 2011  
Aude, Herault, Pyrenees-Orientales, Durban-Corbieres, Castanet-le-Haut, Opoul-Penillos, Canet-en-Roussillon

At the end of October 2011, the south of France was one of the countries affected by a huge low pressure system with the original low Meeno over Ireland. Massive storms brought floods on October 27th and 28th in the regions Aude, Herault, Pyrenees-Orientales, Durban-Corbieres (312,3 mm of rain), Castanet-le-Haut (300,7 mm of rain), Opoul-Penillos (279 mm of rain), Canet-en-Roussillon (216,6 mm of rain). More than 6 people lost their lives during those occasions.

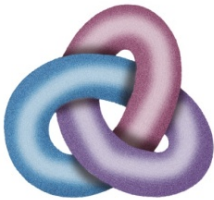
The actual low called Meeno raged over Ireland. Its formation with another low in the southwest of Europe led to a large-scale low-pressure area covering the west coast and many parts in the south of France with huge thunderclouds. New local lows built permanently bringing intense rainfalls.

See also the severe weather events on 3rd and 4th November, 2011 in Genoa (Italy) and 25th October, 2011 in Cinque Terre (Italy).

- 2011/10/28
- 2011/11/03
- 2011/11/04
- 2012/07/05
- 2012/10/27
- 2012/10/28
- 2012/10/29
- 2012/11/22
- 2012/11/23

Selection of 18 cases of flooding  
over Europe and the Mediterranean  
including short description





## Cb-TRAM web application for citizen scientists



DLR - DRIHM - Cb-TRAM - Mozilla Firefox

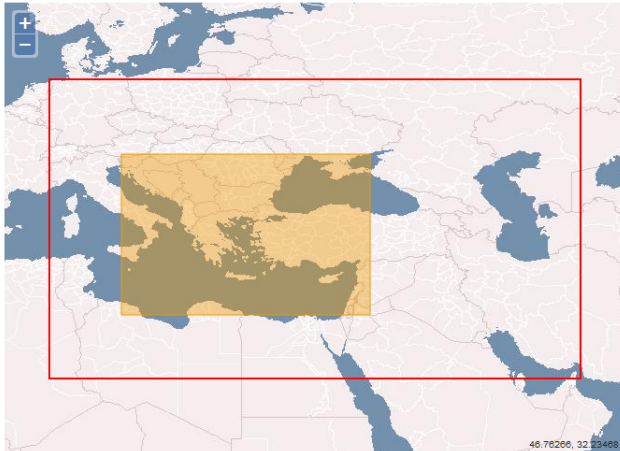
Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

DLR - DRIHM - Cb-TRAM

extern04.pa.op.dlr.de

Map Selection

Select a spatial range using the mouse + SHIFT button.



46.76266, 32.23468

Spatial selection

Longitude Min: 13.735361 Latitude Min: 31.589902 Reset

Longitude Max: 37.135361 Latitude Max: 46.689902

Additional options

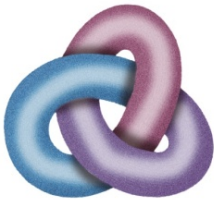
Hover mouse over controls for instructions

Cloud Index: ☐ No Tracks: ☐ Countries: ☒ Rivers: ☐ Gridlines: ☒

Background: HRV Nowcast: ☐ Nowcast plot style: normal

Calculate

- Selection of time, domain, and several options
- Selection of domain with mouse or latitude/longitude values
- Calculate button



## Cb-TRAM web application for citizen scientists

**DLR - DRIHM - Cb-TRAM**

Calculate

25%

**Temporal Selection**

- 2010/06/22
- 2010/06/23
- 2010/06/24
- 2011/10/25
- 2011/10/27
- 2011/10/28
- 2011/11/03
- 2011/11/04

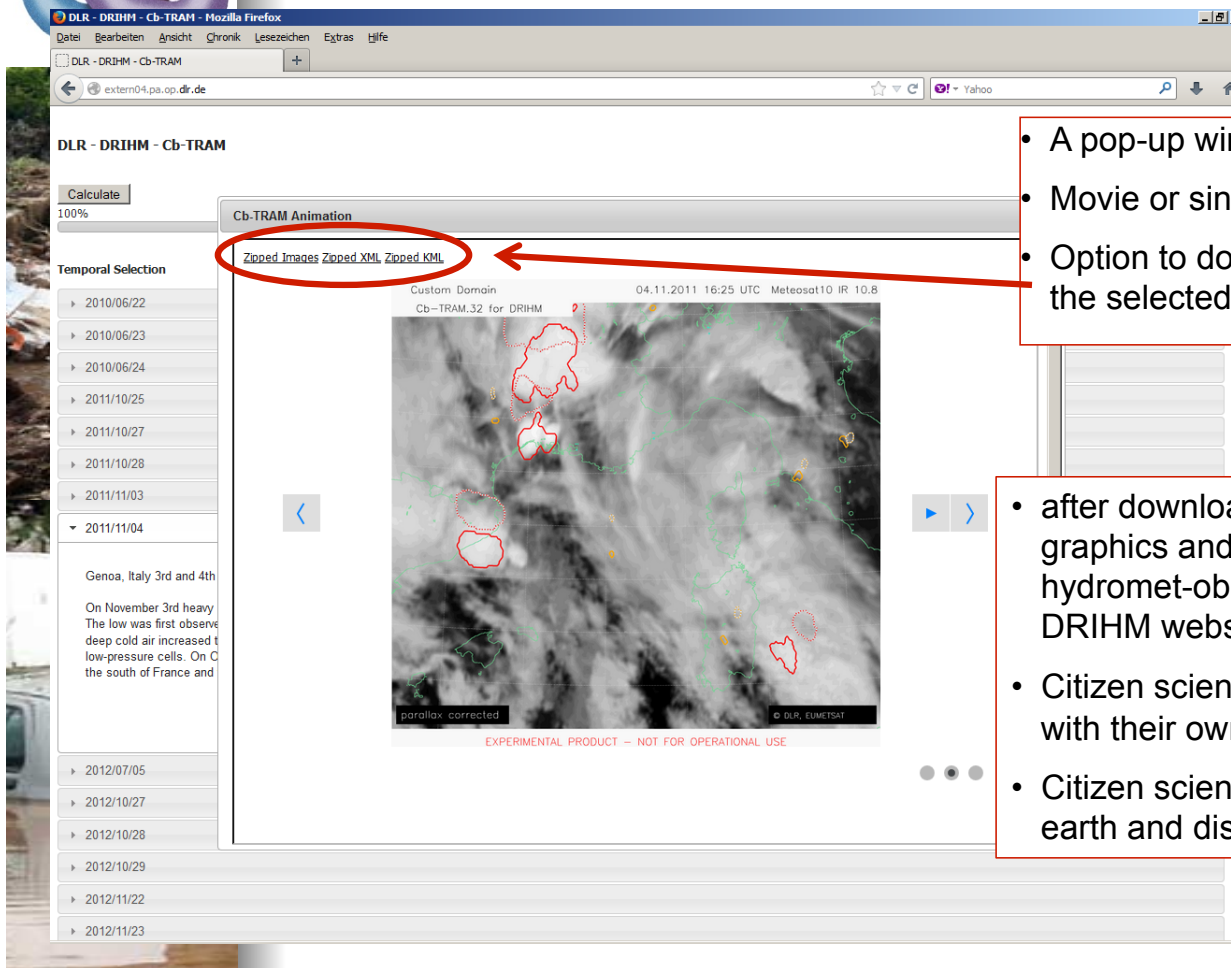
Genoa, Italy 3rd and 4th November, 2011

On November 3rd heavy rainfalls caused flooding through the streets of Genoa bringing death to 7 humans. An extensive low pressure system was moving over western and southern Europe at that time. The low was first observed on October 20th forming in the region of Newfoundland. It was named Meeno. It shaped a strong front and moved eastwards. A collision with a near upper level trough filled with deep cold air increased the intensity of the low pressure area. Moreover, the combination of Meeno with another low over southwestern Europe created a large low pressure system containing smaller low-pressure cells. On October 24th it covered huge areas of the west coast and many southern parts of Europe. These low cells brought storms in Ireland, Great Britain, Portugal, parts of northern Spain, the south of France and the north of Italy but also in Slovenia, Croatia and North Africa. Meeno sustained till the early November.

- 2012/07/05
- 2012/10/27
- 2012/10/28
- 2012/10/29
- 2012/11/22
- 2012/11/23

- Progress bar indicates the progress of the calculation

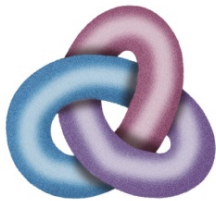
## Cb-TRAM web application for citizen scientists

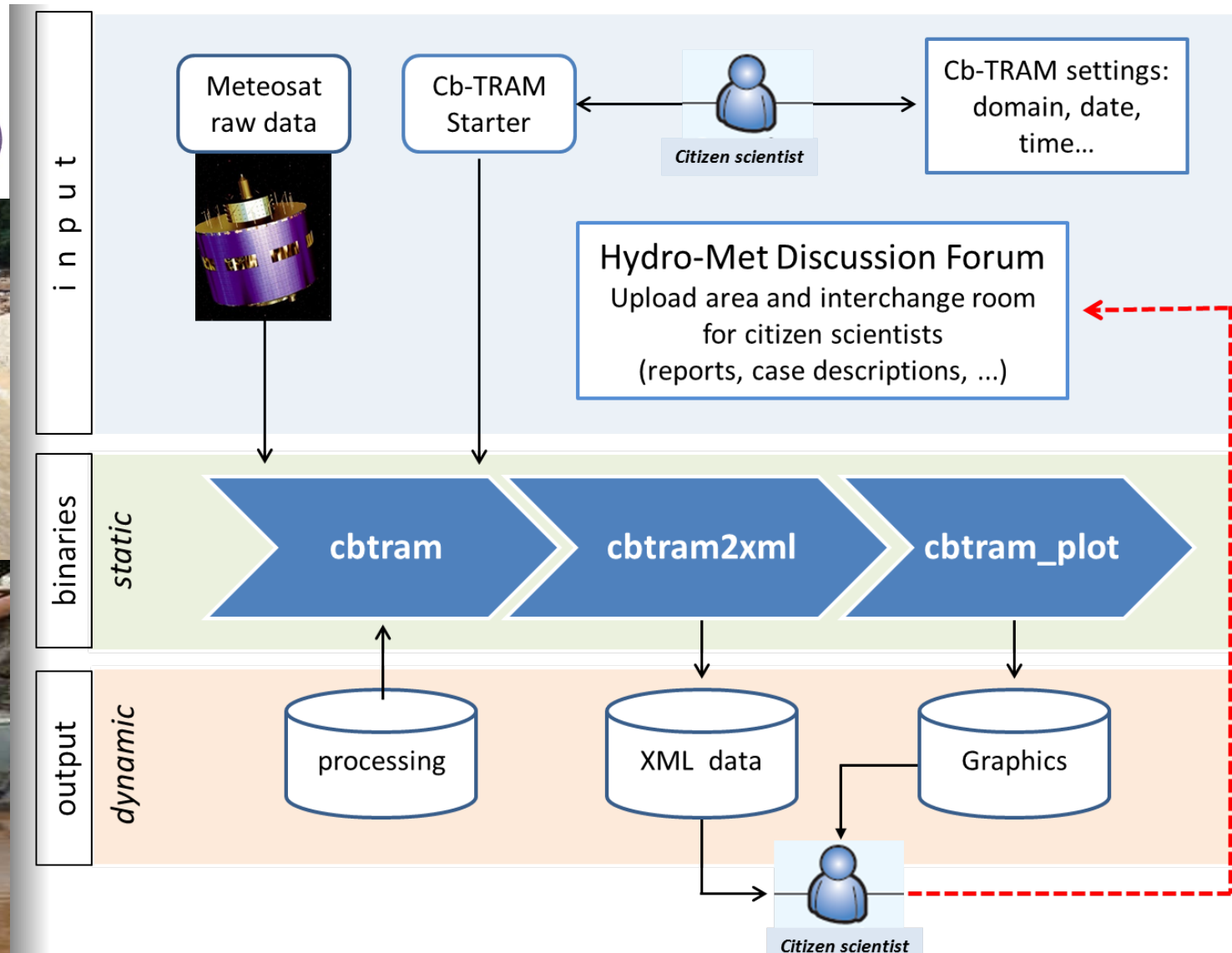
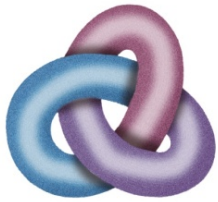


- A pop-up window appears
- Movie or single images are shown
- Option to download images, xml, and kml files for the selected region, date and time

- after download, citizen scientists can upload Cb-TRAM graphics and their own material they collect (photographs, hydromet-observations, etc..) on the DRIHM forum on the DRIHM website.
- Citizen scientists can "mix" Cb-TRAM output (XML, KML files) with their own analyses and graphics
- Citizen scientists can upload Cb-TRAM KML-files into google earth and display Cb-TRAM output in 3-D











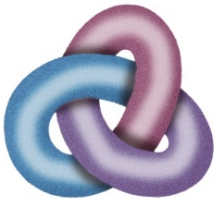
Feedback of citizen scientists to Cb-TRAM web application on DRIHM web site (users forum)  
<http://www.drihm.eu/index.php/forum/8-general/77-cb-tram-feedbacks-fro>

March 2014 QUESTIONNAIRES REPORT by Edoardo Mazza (Meteonetwork)

Table of evaluation.

Rates scale: 1- very poor, 2- unsatisfactory, 3- about average, 4-good, 5- superior

Q1: In your opinion, is Cb-TRAM quite intuitive?	Average rate: 4.26/5
Q2: Is Cb-TRAM interface user-friendly?	Average rate: 4.10/5
Q3: How do you evaluate the execution time?	Average rate: 3.05/5
Q4: How presented critical cases are interesting to you?	Average rate: 4.42/5
Q5: Was the output of the Cb-TRAM web application (images, xml, kml) useful for you?	Average rate: 4.68/5
Q6: How would you rate the service as a whole?	Average rate: 4.10/5



Summary of answers:

Q7: Could Cb-TRAM be useful to you in the frame of your professional interests?

- Sure, especially as **a tool to support short term forecasting and warning**
- Yes, sure.
- Yes, sure.
- Of course, especially as a support during nowcasting
- In principle yes. I'd like to test its performance with real time data though.
- Sure, Cb-TRAM could be a very useful tool.
- Yes. It can be **a first step towards a more stable cooperation and even more contributions from citizen scientists.**
- Yes, very useful.
- It is a great tool.
- Sure, it could have many applications even for citizen scientists activities
- Yes, sure.
- Sure, as long as it's free of charges
- Sure, it has many possible practical and more theoretical applications
- Sure, I think it's **a fairly innovative tool.**
- Yes.
- Yes, **it is really interesting to have a closer look at such events**
- Sure. **Very useful during severe weather events from a nowcasting perspective.**
- Of course, could be very useful in order to minimize the damage associated with severe weather.



Q8: How could you use the Cb-TRAM output files?

- To **support analysis of thunderstorms**
- To study the tracks of convective cells during past events and if possible to identify preferential - paths of thunderstorms in a specific area.
- **To create an archive of past events to be used as an educational tool.**
- As an integration to other data sets coming from different sources.
- To understand the evolution of thunderstorms in the past and better understand their possible behaviour under a similar synoptic scenario.
- **I could compare them to other outputs from different softwares.**
- To create an historical archive of severe weather events
- First, to create an archive and also to understand the “speculate” about the possible evolution of future events based on our prior knowledge.
- Sharing and archiving them.
- **To create an archive**
- **Real time monitoring of severe weather events; building case studies for NWP models verification**
- **To study the interaction of convective cells with complex orography**
- To re-investigate past events.



Q9: In your opinion, how could the Cb-TRAM service be improved?

- The moving windows feature is problematic. I'd prefer them to be fixed and not one inside the other. The map plot crashes if I click on the "OpenStreetMap" link, both in domain selection stage and in the visualization one. It would be great to highlight more the legend describing the color code associated to cells.
- It would be great to speed up the thing a little bit and making the software interface a little bit more captivating
- It would be great to have the possibility of zooming over a given area even during the visualization stage; to speed it the execution time but keeping the interface intuitive. If possible it would be great to combine this information with precipitation data coming from Radar or MPE channel from Eumetsat.
- by providing a real-time application
- Maybe by adding some more geographical details in the map and making some graphical tuning of the interface, however it is already very intuitive and user-friendly.
- By providing a very detailed user-guide.
- By increasing the number of past events in the archive
- Cb-TRAM could be improved by reducing images load-time and removing the actual multi-windows structure of the web page.
- Speeding up the execution time and having the chance to look at the .xml data on the web page.
- by combining it with radar images
- by overlapping the output with some NWP model parameters plots.



Reply to questionnaire by C. Forster (DLR), April 2014

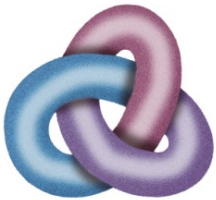
Dear Edoardo,

Thank you very much ... specific requirements mentioned by the users in Q9:

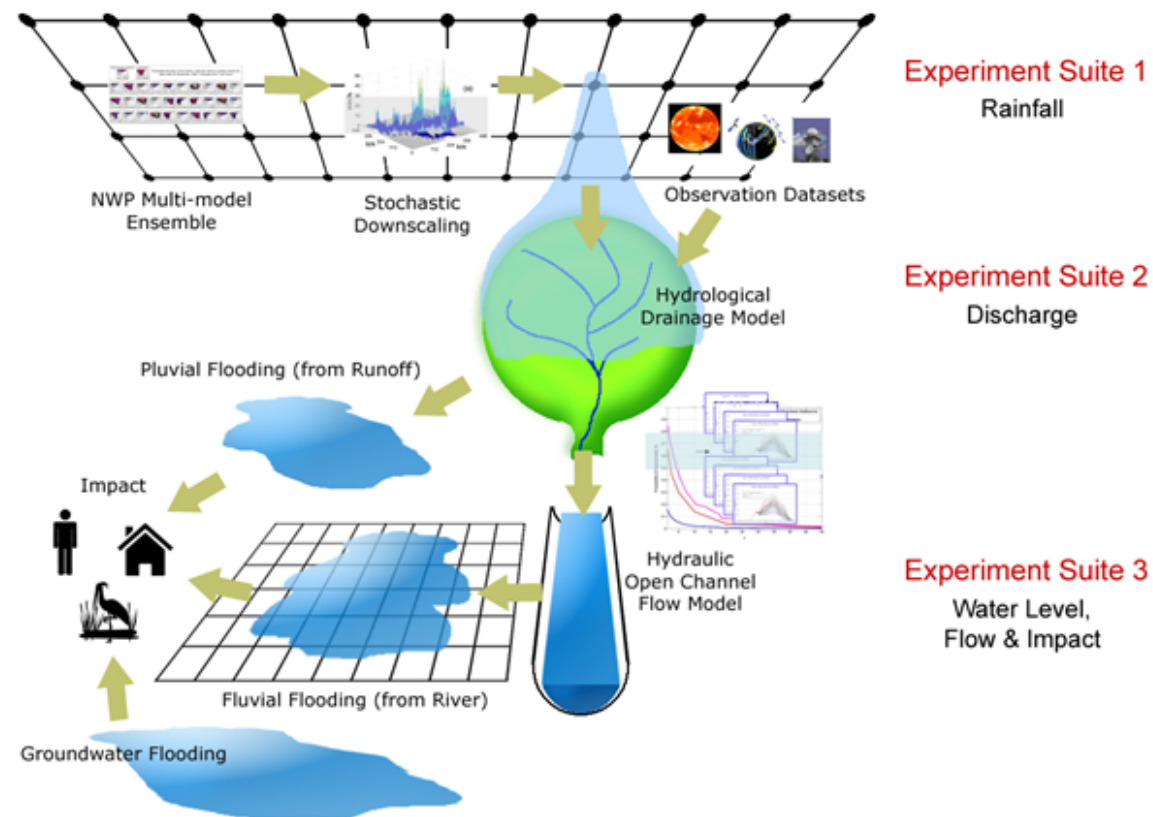
- Execution time: ....
- Overlay of Cb-TRAM with other data sources (e.g. radar, NWP model data etc.): ...
- Cb-TRAM as real time application: ...
- Problems regarding zooming or viewing the web site: ...
- DLR will provide a user guide ...
- Some users asked for Cb-TRAM results for specific cases of flooding events, e.g. over Great Britain ...

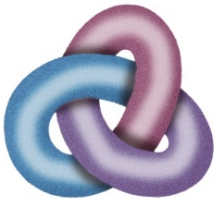
Best regards,  
Caroline Forster, DLR



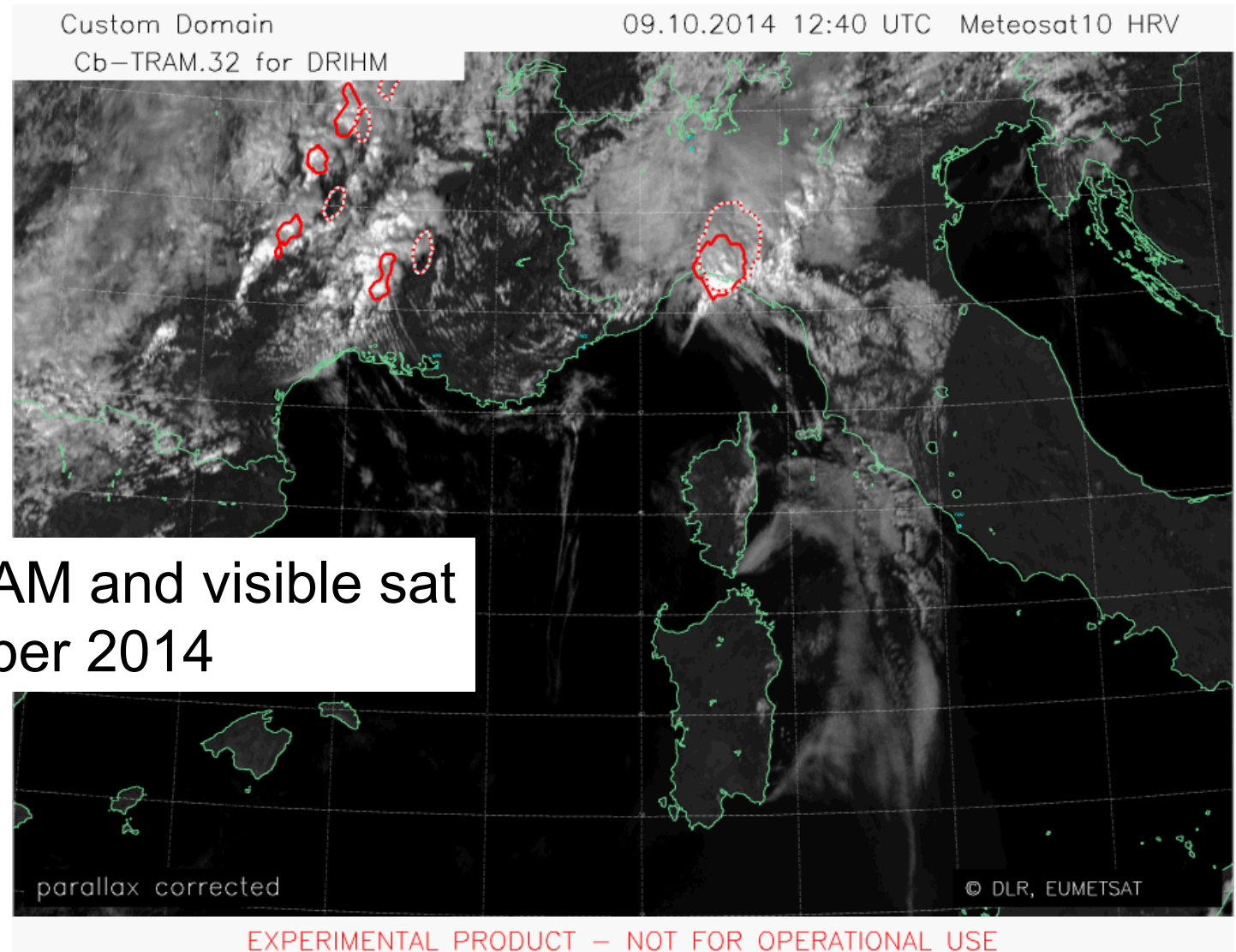


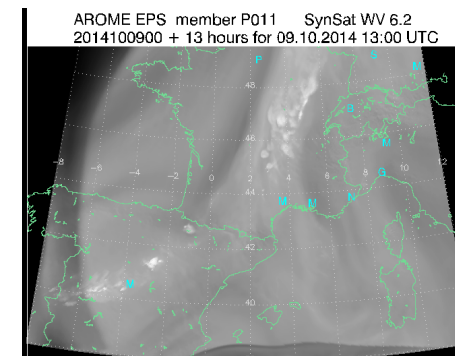
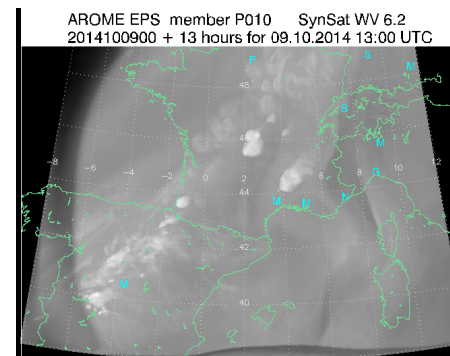
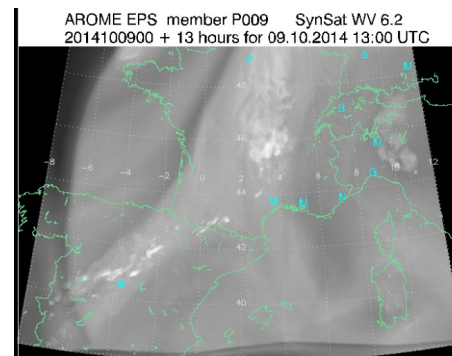
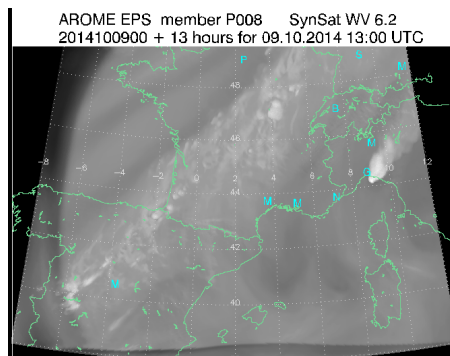
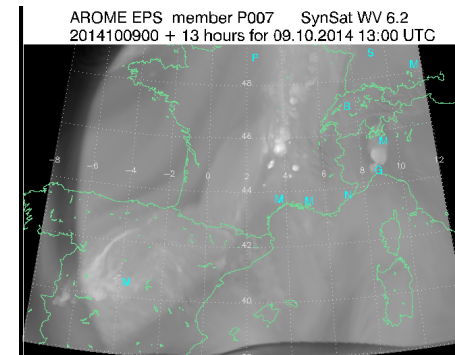
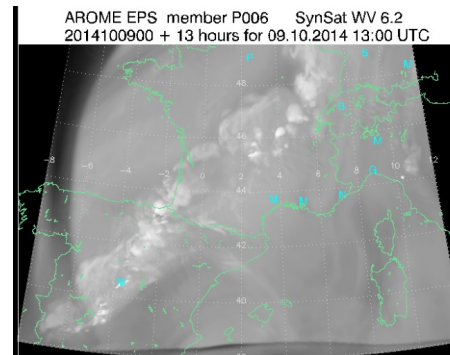
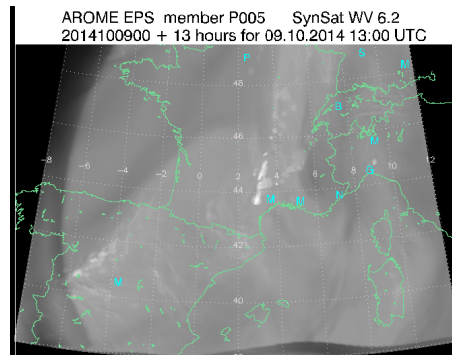
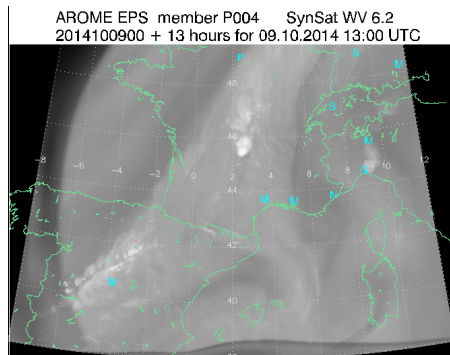
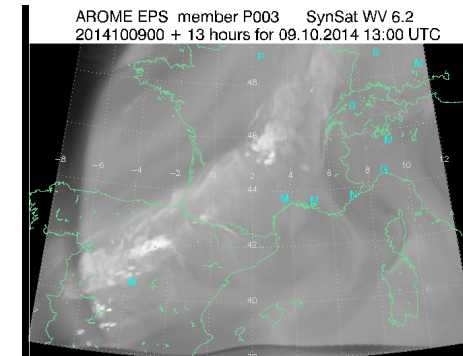
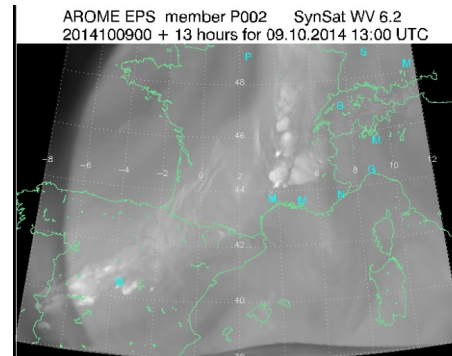
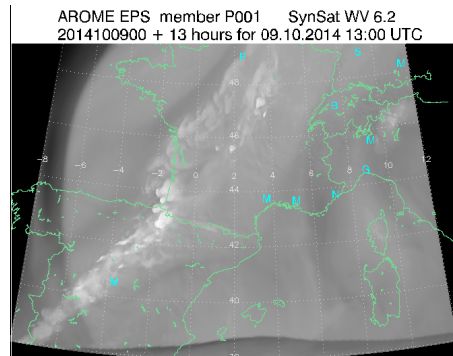
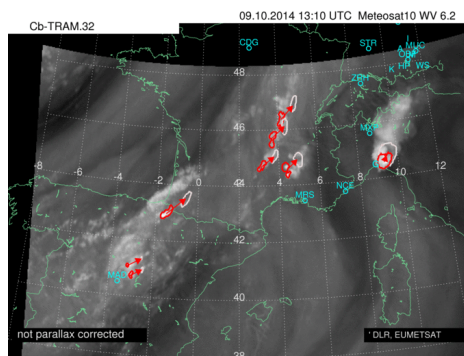
## Use of Cb-TRAM for best member selection developed in the framework of DRIHM



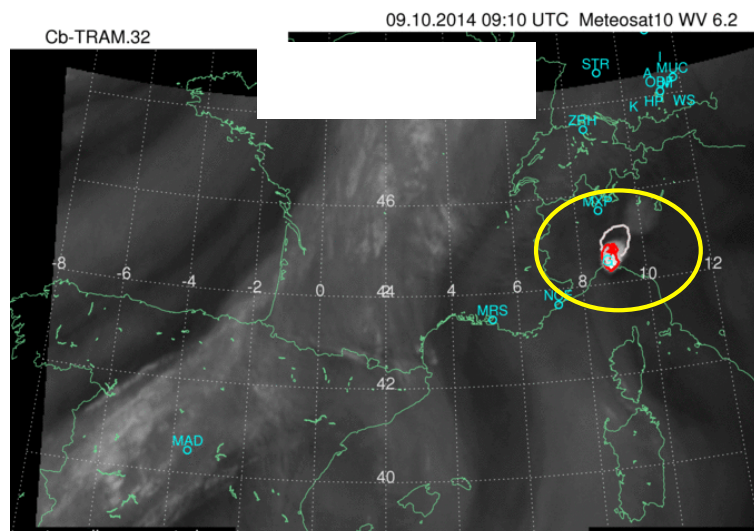


## Cb-TRAM and visible sat 9 October 2014

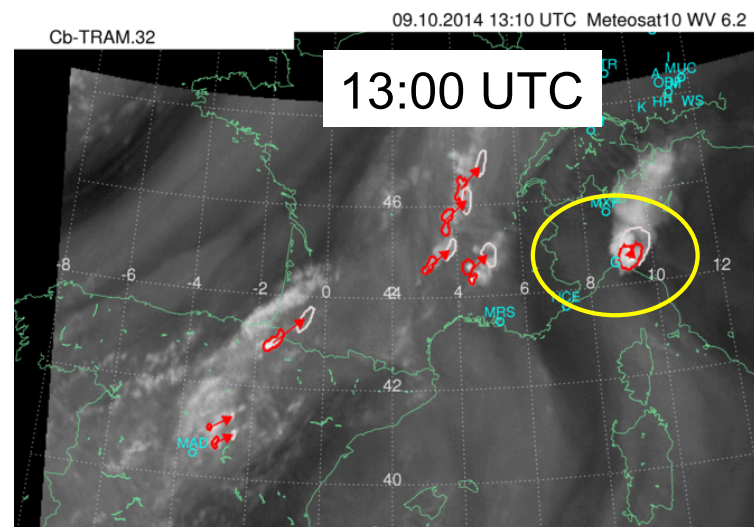
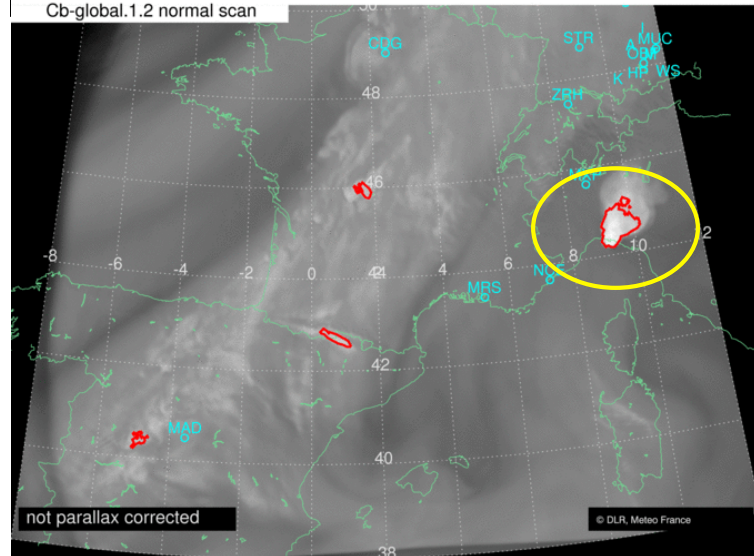




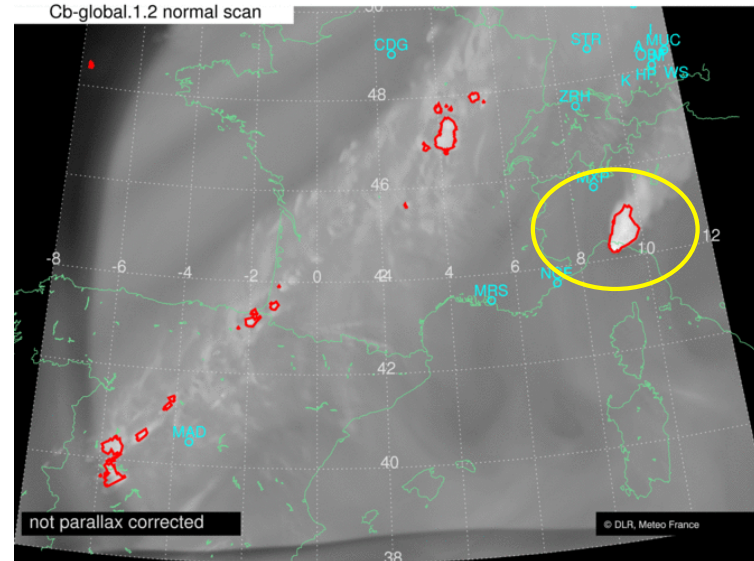


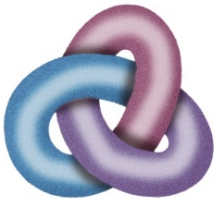


WV6.2 9.10.2014 0 UTC 9 hrs forecast AROME Member P008  
Cb-global.1.2 normal scan

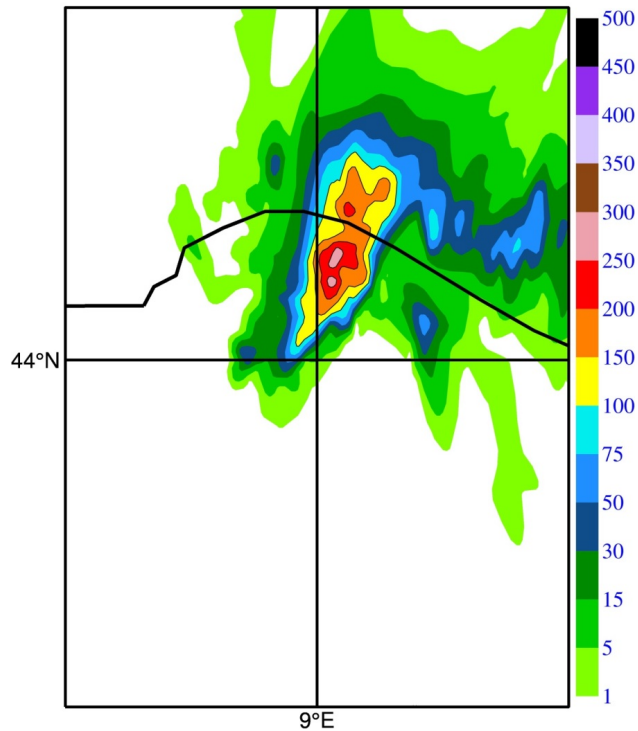


WV6.2 9.10.2014 0 UTC 13 hrs forecast AROME Member P008  
Cb-global.1.2 normal scan



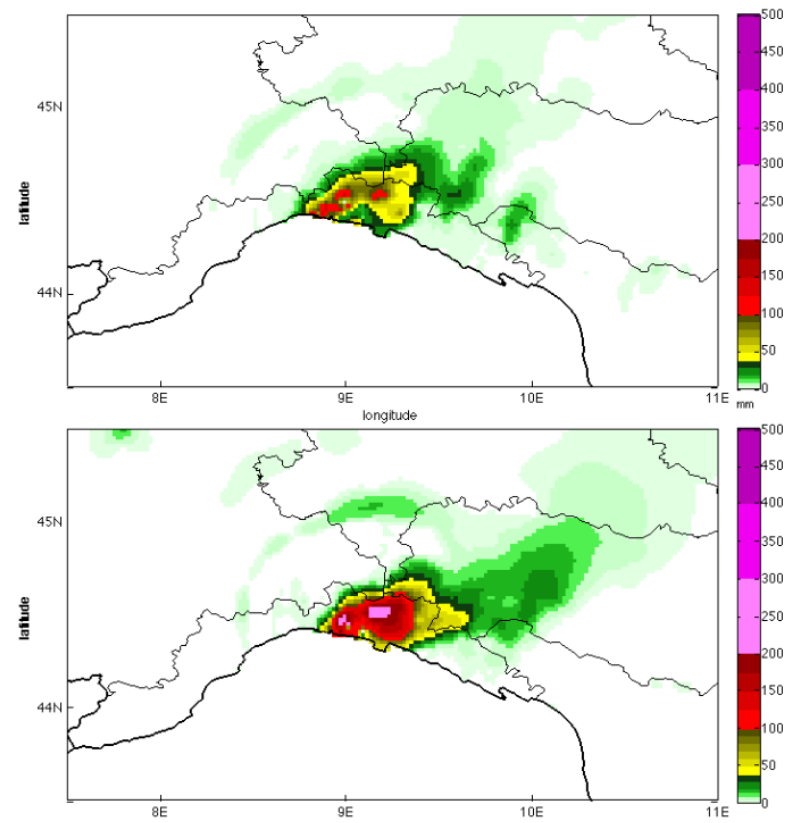


## 24 hour precipitation sums of 9. October 2014



**AROME best member 8**

Olivier Nuissier: „the member P008 is the sole of the ensemble to produce rainfall amounts approaching 300 mm/24h“



**Observation**

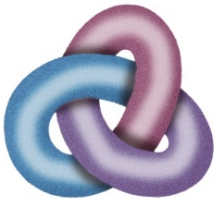




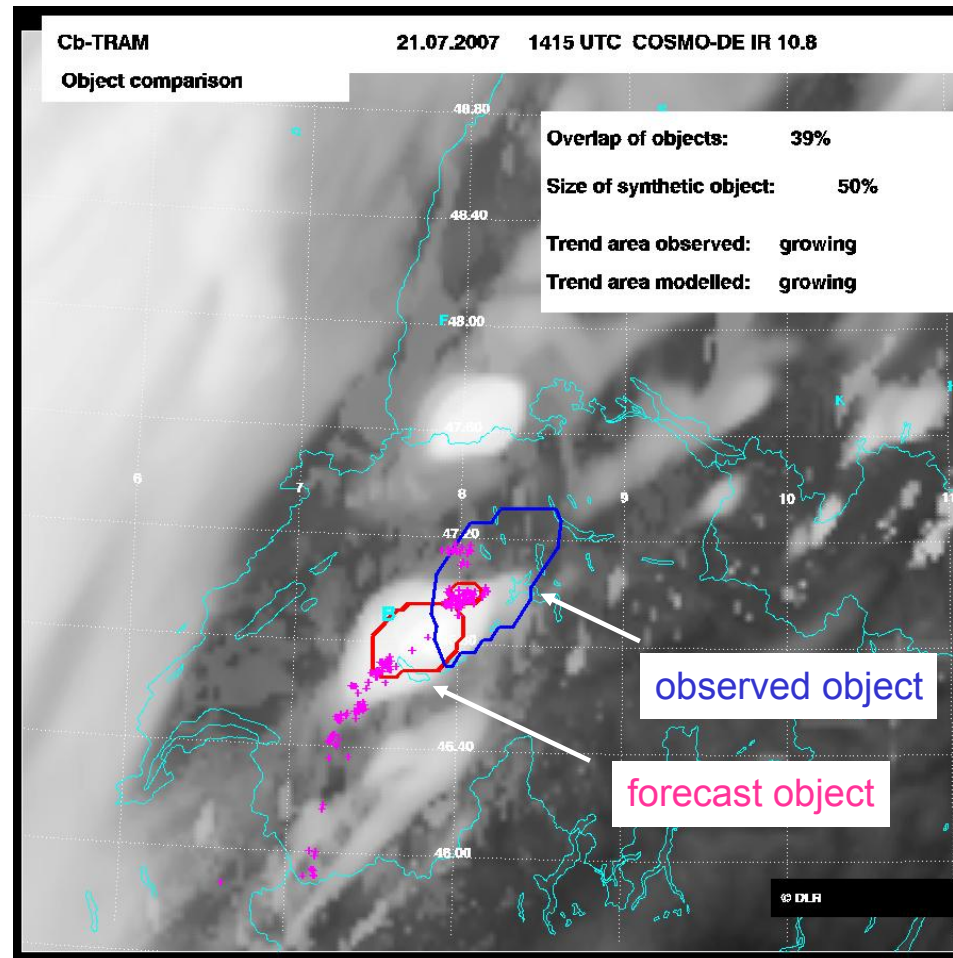
Summarizing it can be concluded that a real time online verification of the ensemble forecast would have made it possible to detect the danger for flooding already at 9:00 UTC on 9 October 2014.

This is because:

- Cb-TRAM detects thunderstorms in both synthetic (member P008) and real satellite data near Genoa
- The thunderstorm near Genoa is not a transient feature in member P008, but persists for about 5 hours after 0900 UTC
- The precipitation forecast of P008 shows large amounts of rainfall exceeding 200 mm over 24 hours

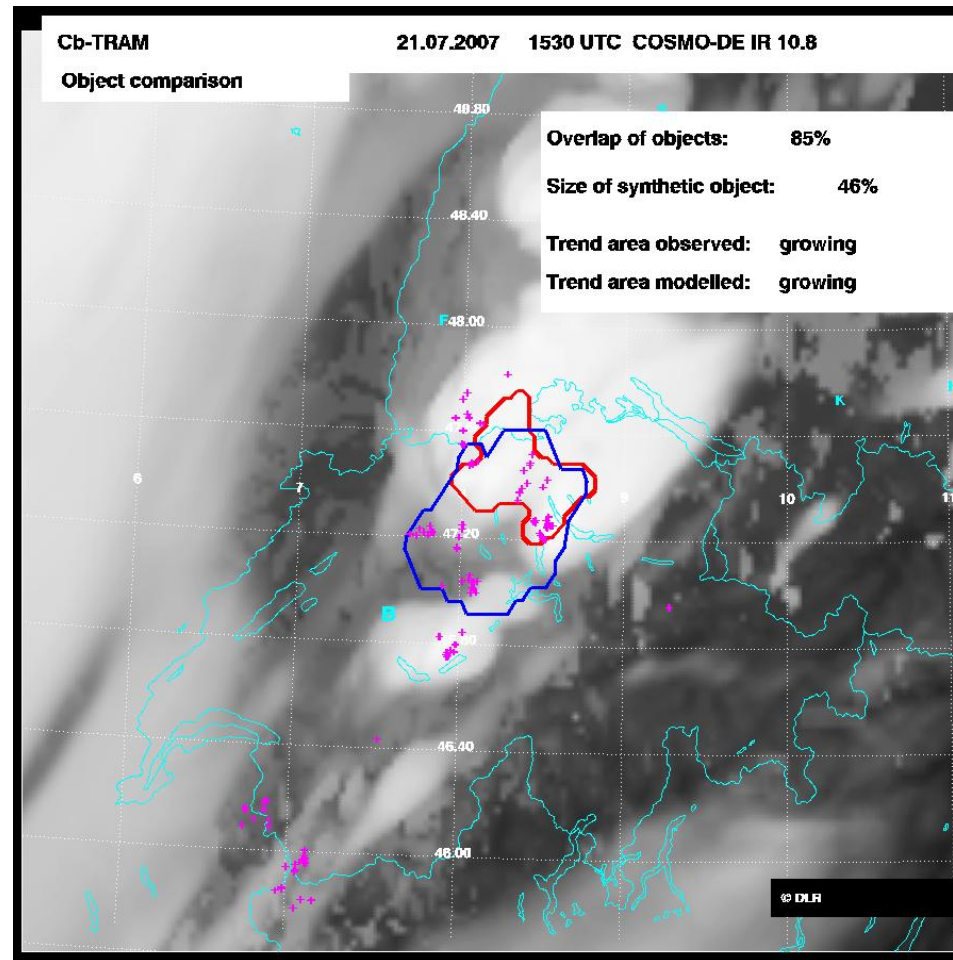


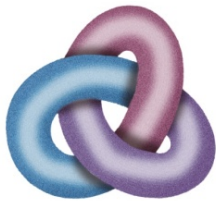
## Needed: Real Time Automatic Best Member Selection



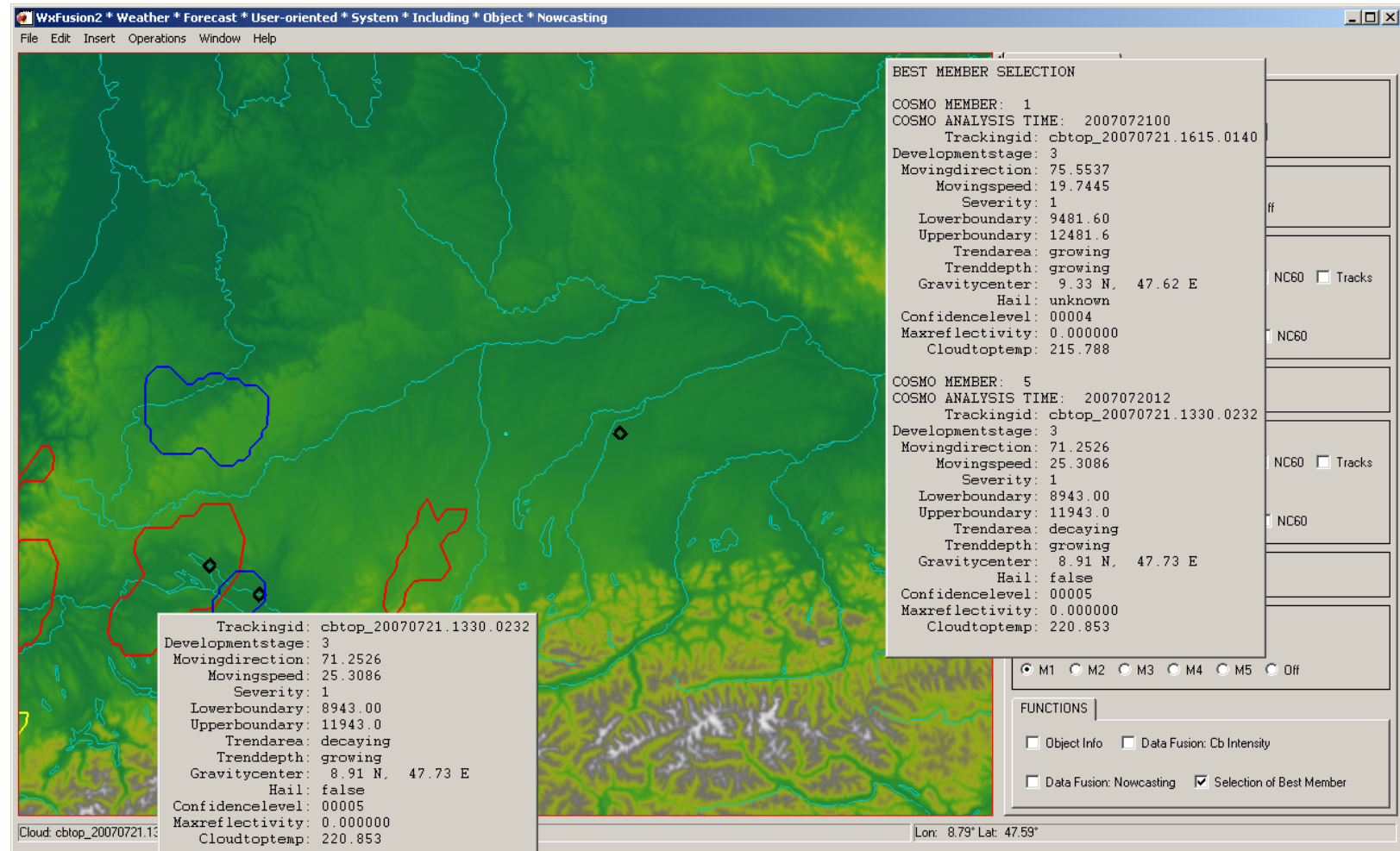


## Outlook: Real Time Automatic Best Member Selection





## Outlook: Real Time Automatic Best Member Selection







## Summary: DRIHM and the citizen scientist

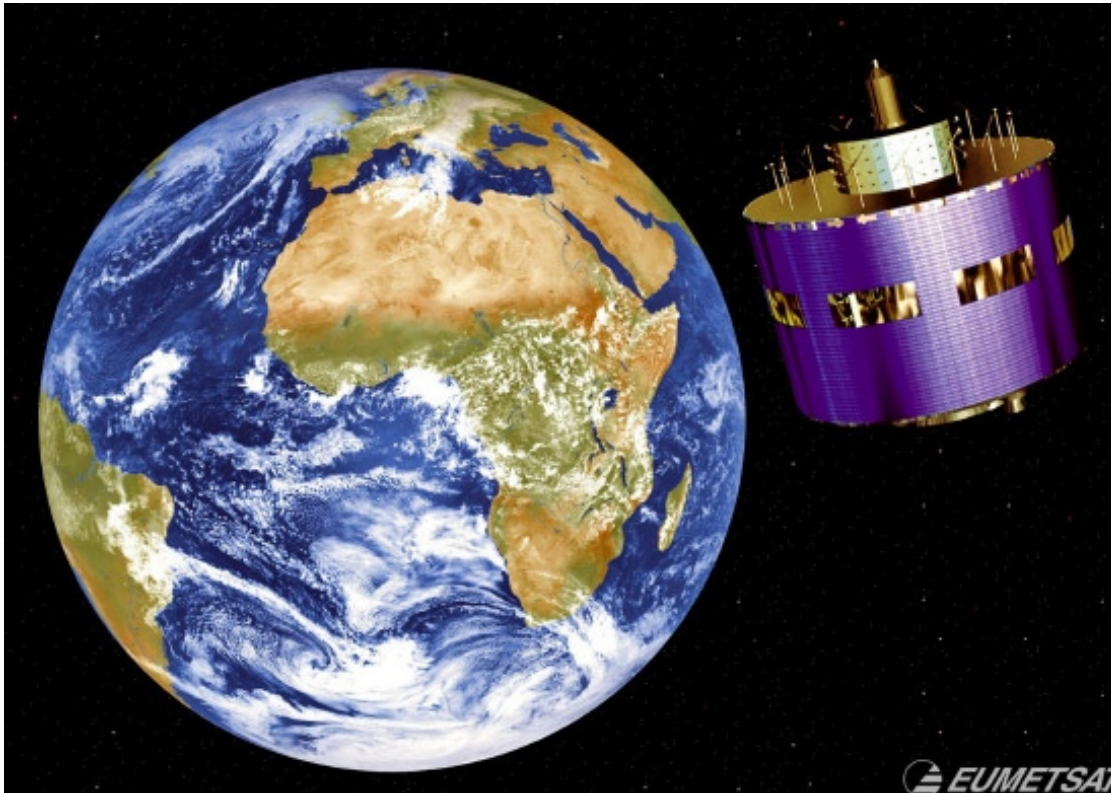
- DRIHM Service for Citizen Scientists installed  
<http://portal.drihm.eu/cbtram>
- Feedback from Citizen Scientists positive
- User Guide: DLR Cb-TRAM Web Application for citizen scientists
- DRIHM newsletter: DRIHM and the citizen scientist (10. July 2013)
- DRIHM paper in preparation:  
“Improving flood forecasting by ensemble best member selection”,  
A. Tafferner, O. Nuissier, C. Forster, ...

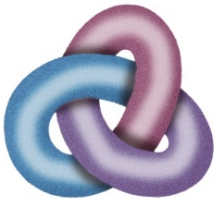




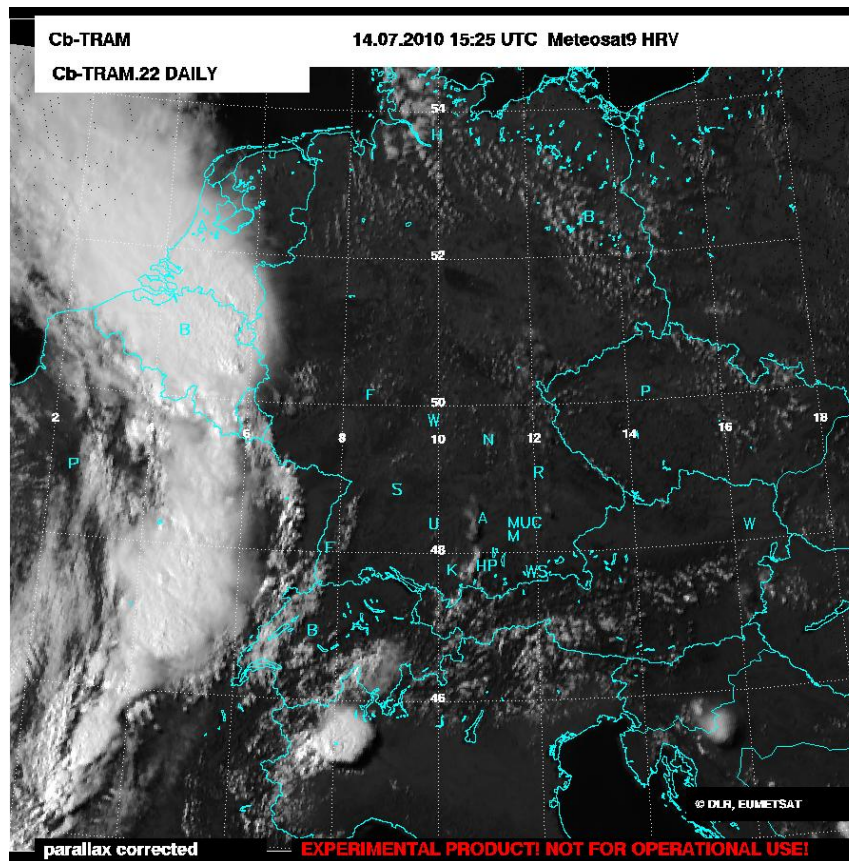
## Cb-TRAM: Cumulonimbus Tracking and Monitoring

area of application, use of METEOSAT data





## Cb-TRAM: Cumulonimbus Tracking and Monitoring

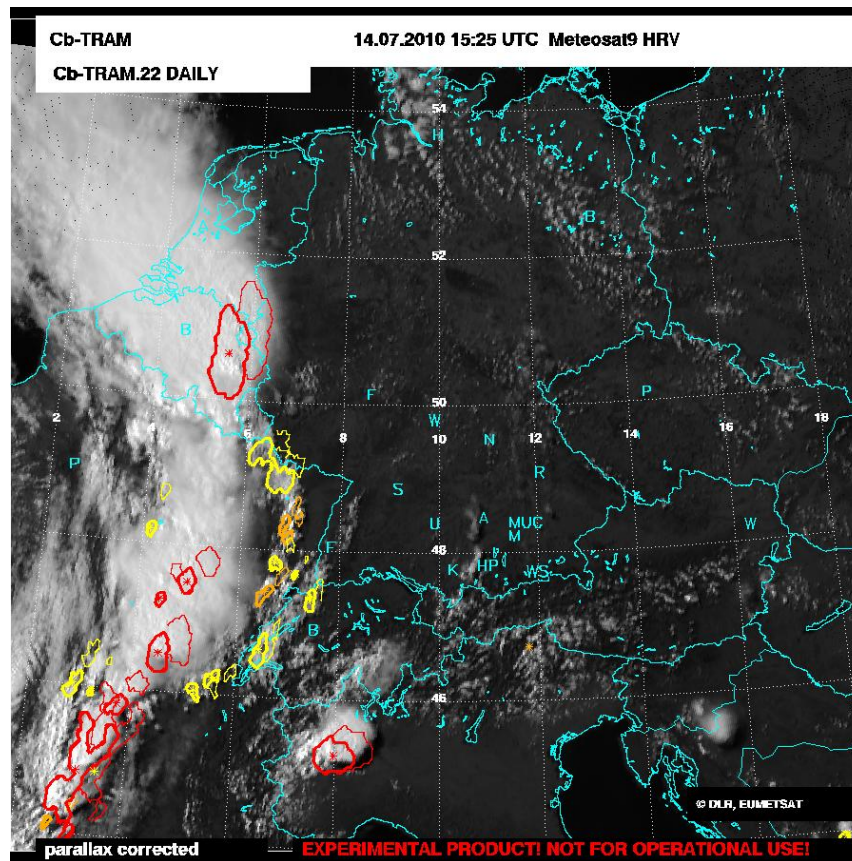


14. Juli 2010 15:25 UTC





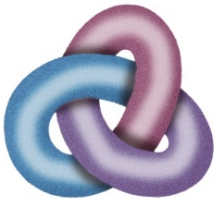
## Cb-TRAM: Cumulonimbus Tracking and Monitoring



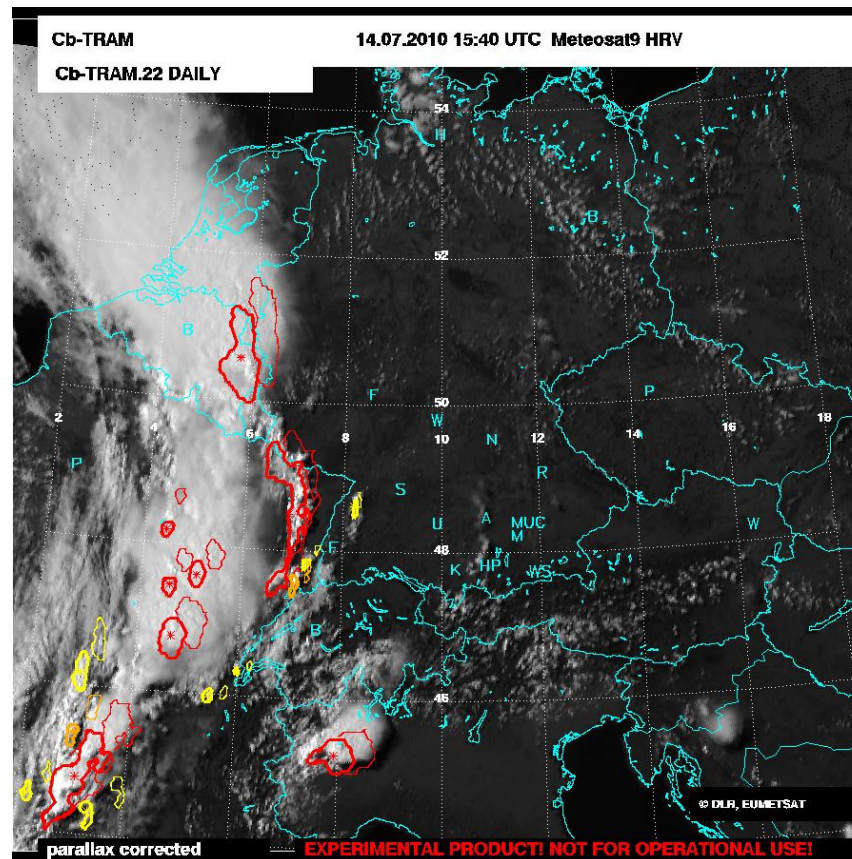
**From satellite data  
3 development stages:**

- convection initiation (yellow)
- rapid development (orange)
- mature stage (red)
- 30 min Nowcast (thin contours)

14. Juli 2010 15:25 UTC



## Cb-TRAM: Cumulonimbus Tracking and Monitoring



**From satellite data  
3 development stages:**

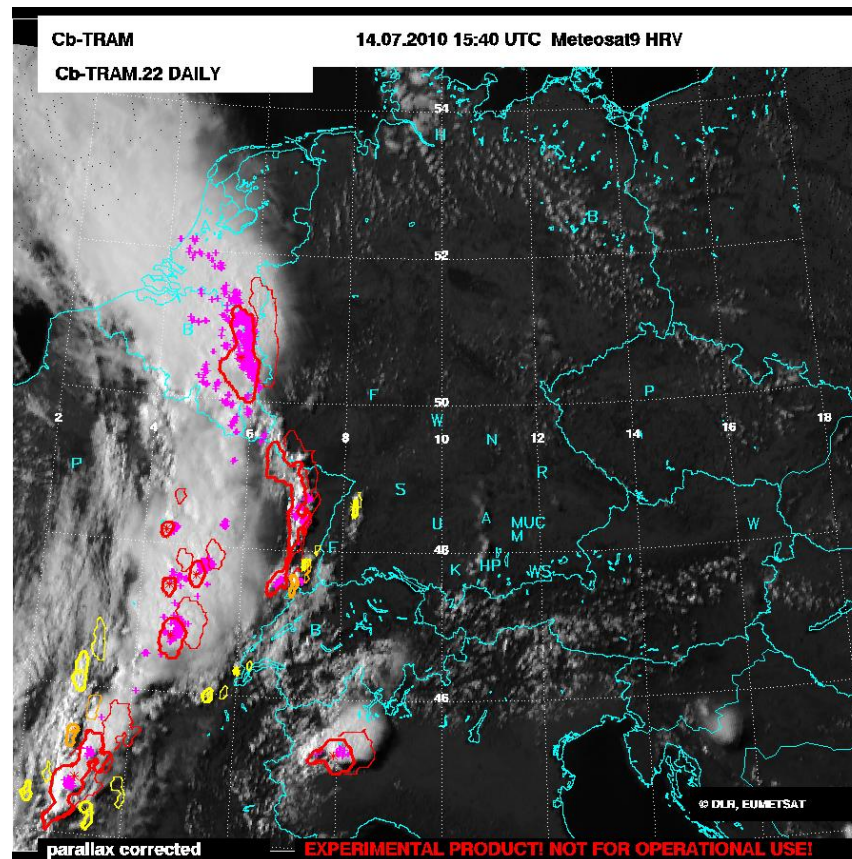
- convection initiation (yellow)
- rapid development (orange)
- mature stage (red)
- 30 min Nowcast (thin contours)

14. Juli 2010 15:40 UTC





## Cb-TRAM: Cumulonimbus Tracking and Monitoring



**From satellite data  
3 development stages:**

- convection initiation (yellow)
- rapid development (orange)
- mature stage (red)
- 30 min Nowcast (thin contours)
- overlay with lightning data (LINET)

14. Juli 2010 15:40 UTC