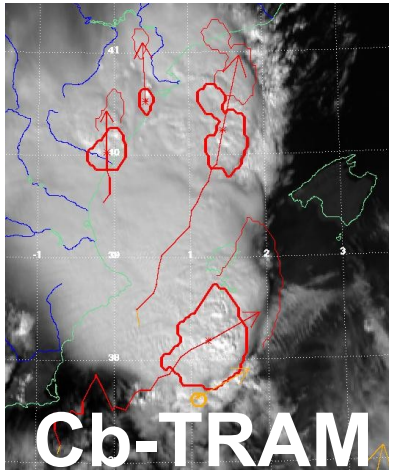

Tracking and monitoring severe convection over the Mediterranean from onset over rapid development to mature phase using multi-channel Meteosat SEVERI data

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Caroline Forster, Hermann Mannstein, Tobias Zinner

4th HyMeX Workshop, Bologna, 8 June 2010

DLR Deutsches Zentrum für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Institute of Atmospheric Physics

Cb-TRAM Thunderstorm tracking and monitoring

(Zinner, Mannstein, Tafferner, 2008; Zinner and Betz, 2009)

Three detection phases:

- Initiation of convection
- Rapid development
- Mature state

Use of four Meteosat SEVIRI channels:

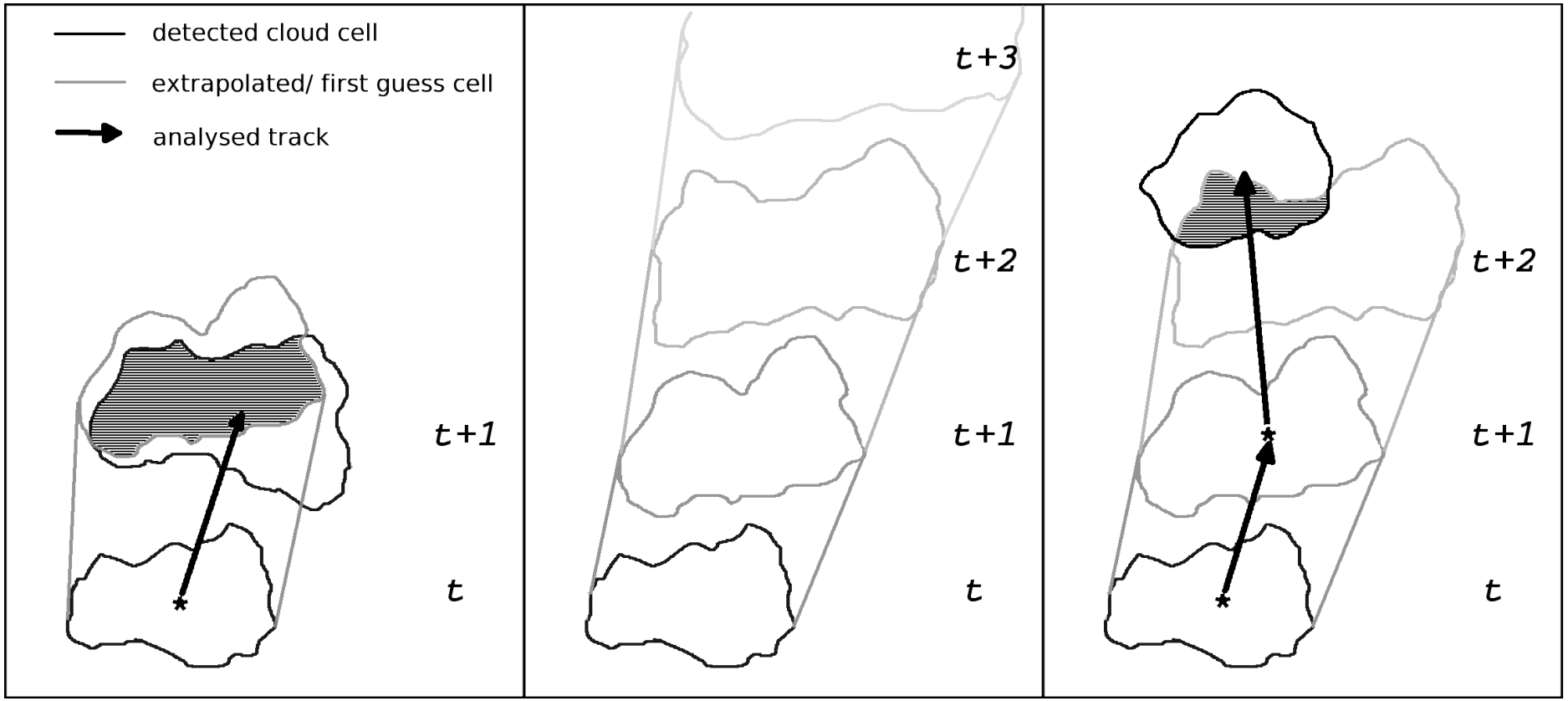
- HRV
- IR 10.8µm
- IR 12.0µm
- WV 6.2µm

Pyramidal Matching for correlating Meteosat image pairs

- tracking
- Nowcasting

ECMWF forecast data used for cloud top height calculation

Cb-TRAM Thunderstorm tracking and monitoring



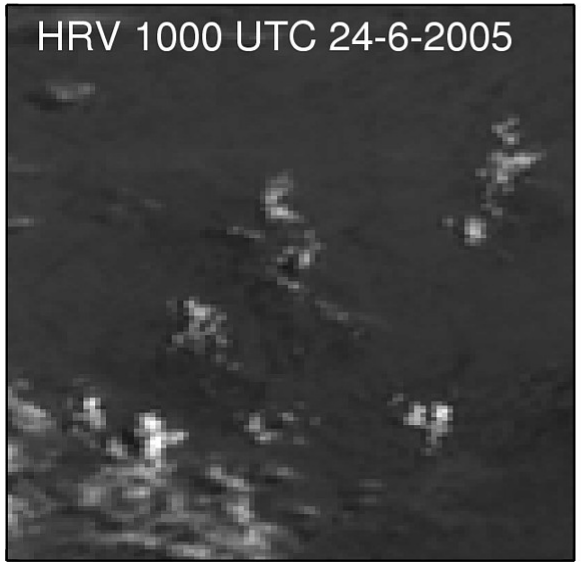
Detection & Tracking

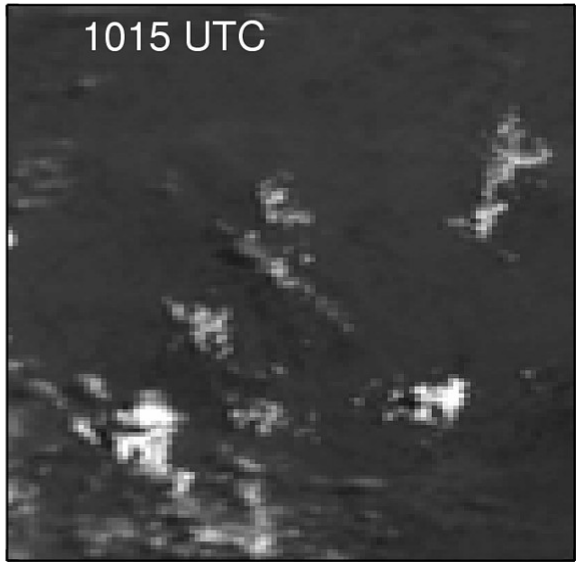
Nowcasting

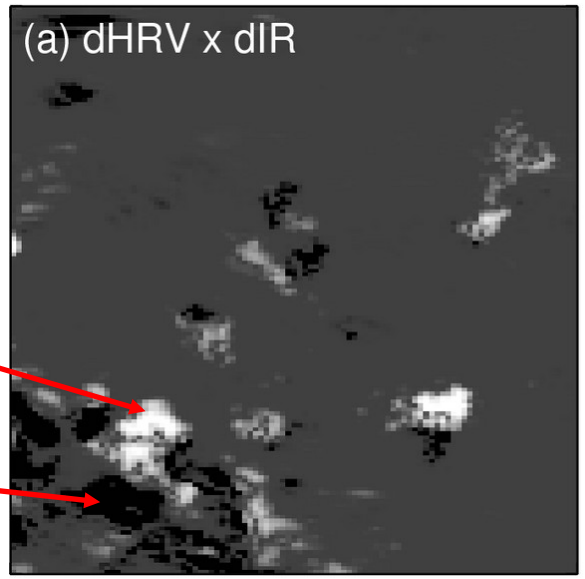
Monitoring

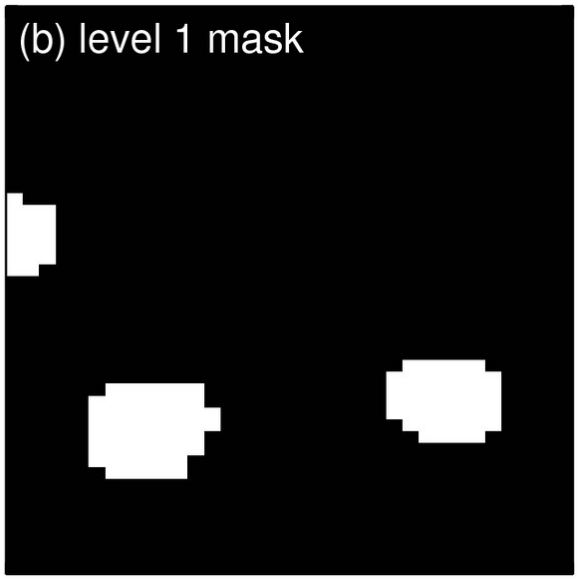
1. **Initiation**: Detection of beginning convection

Criterion:
Development in HRV field with accompanying cooling in the IR 10.8 field





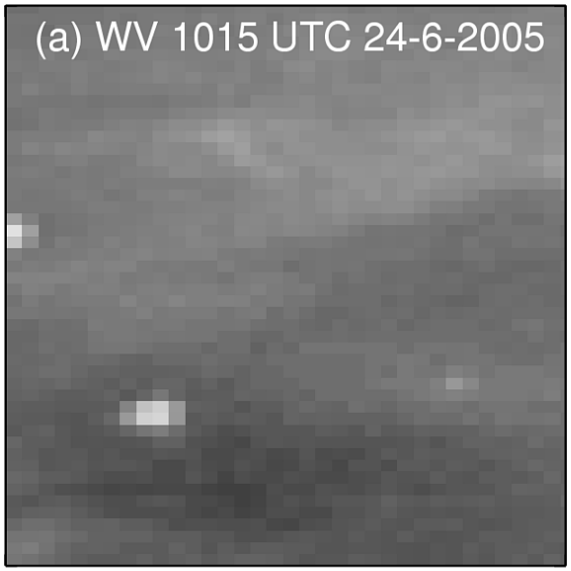


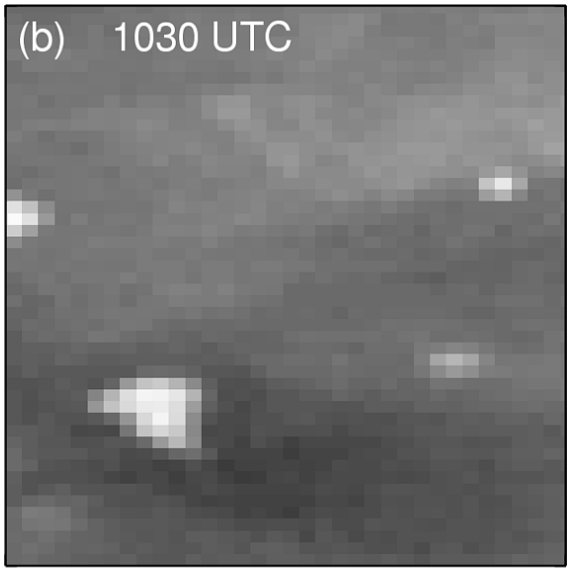


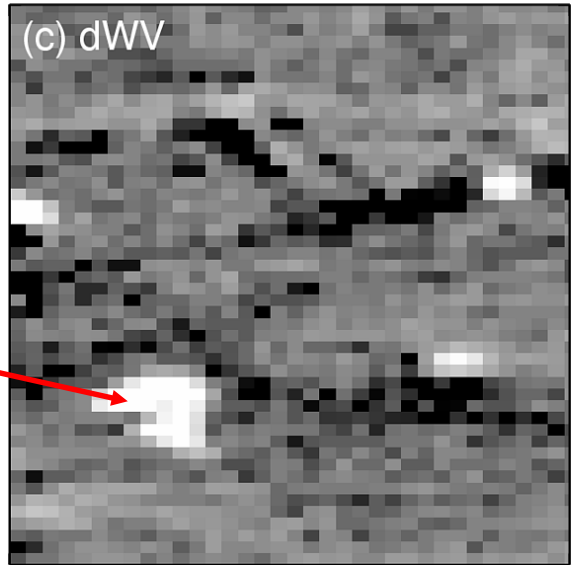
Areas of
- cloud growth - bright
- cloud dissolution - dark

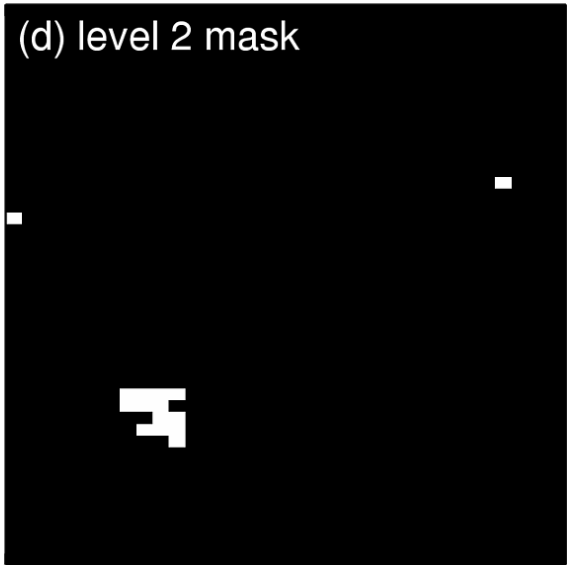
2. Rapid development

Criterion:
cooling > 1.5K/15 min
in WV field









Rapid cooling

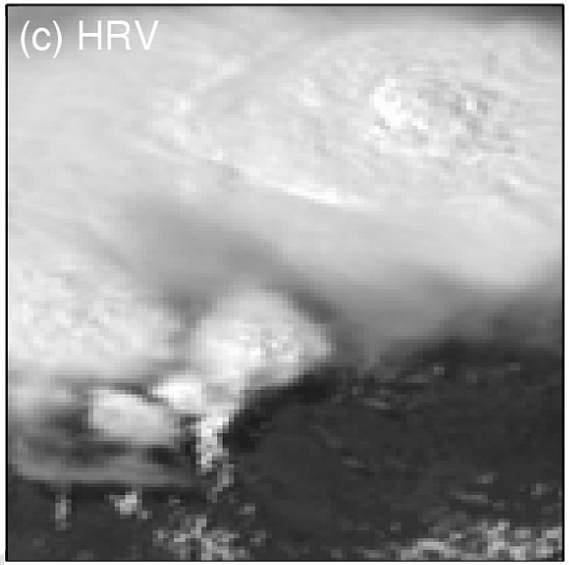
3. Mature phase

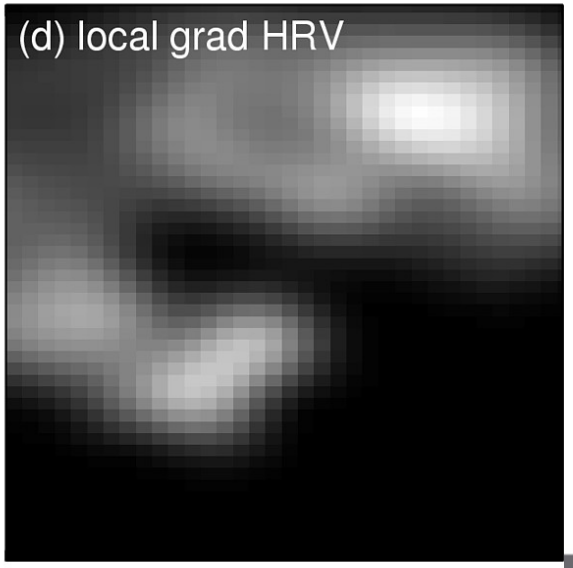
Criteria:

T (6.2µm) - T (10.8µm) > 0
Cloud tops are suspected to reach or overshoot the tropospheric background which is a clear sign of strong convective activity

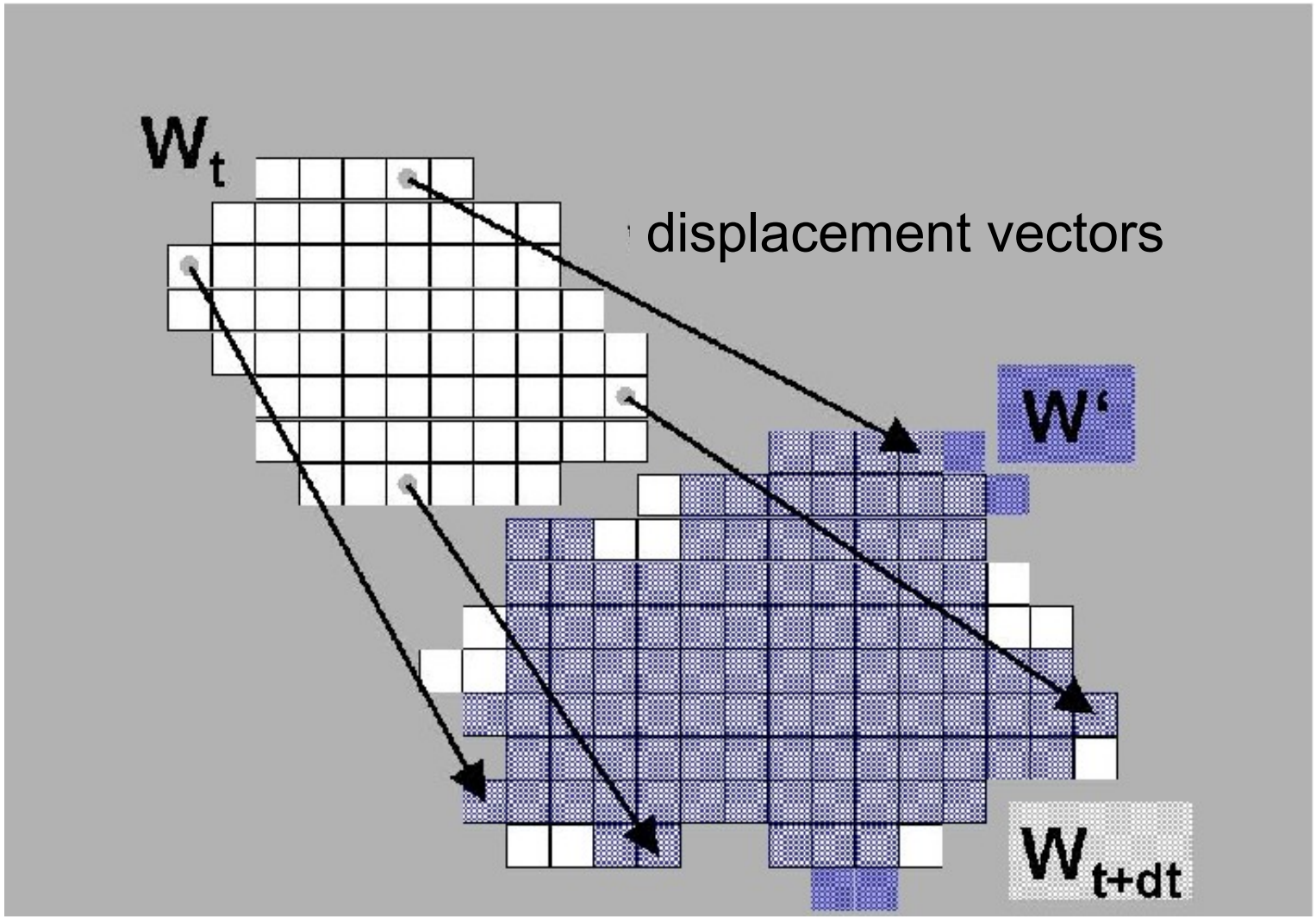
HRV texture:
Local standard deviation of HRV reflectivity as threshold for convective cells

T_10.8 - T_12.0 > 0
Thin ice clouds are filtered





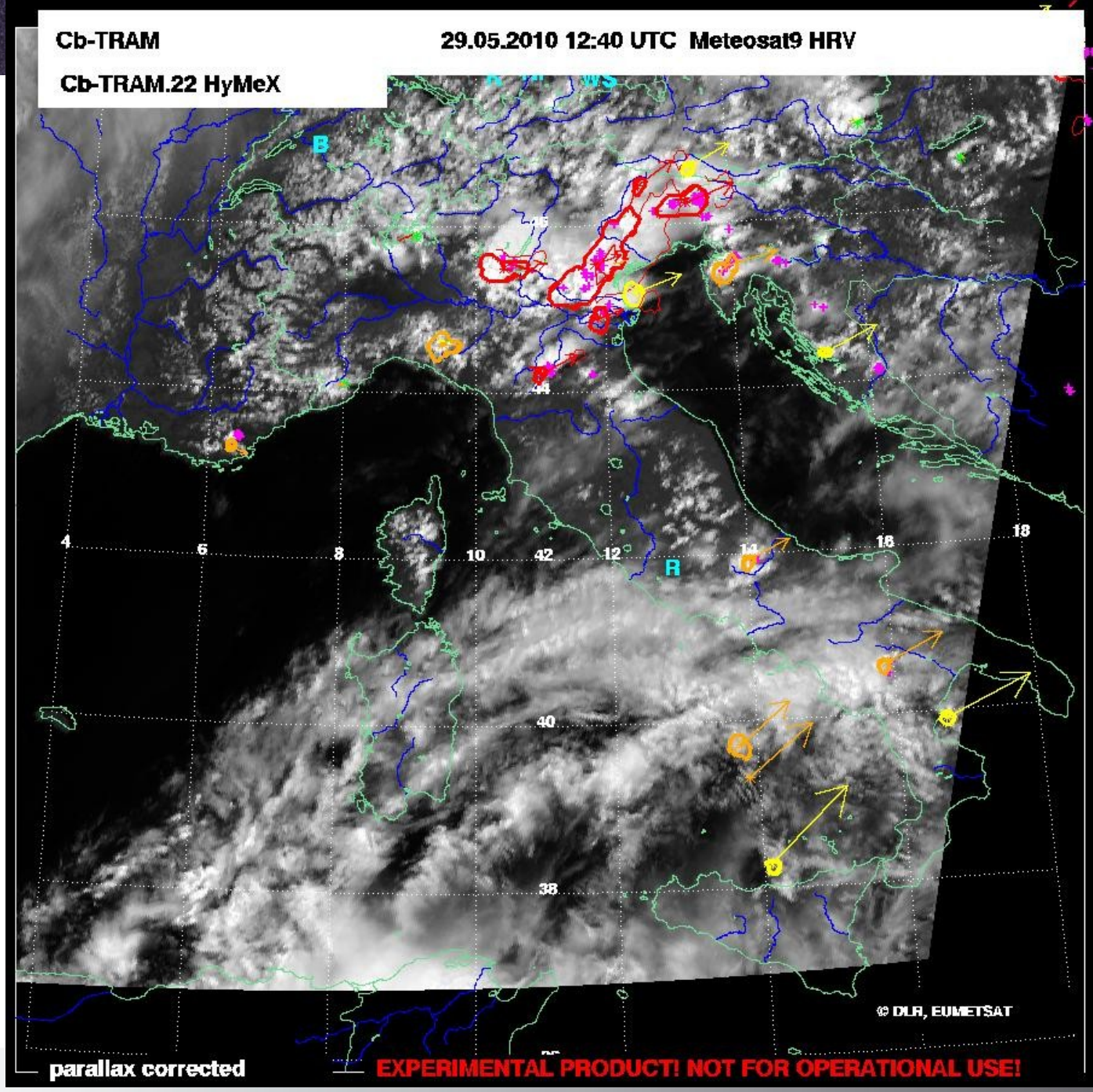
Nowcasting detected cells



29 May 2010

Cb-TRAM contours:
initiation
rapid growth
mature
60 min nowcast
(thin red lines)

++ lightning obs
LINET (nowcast GmbH)



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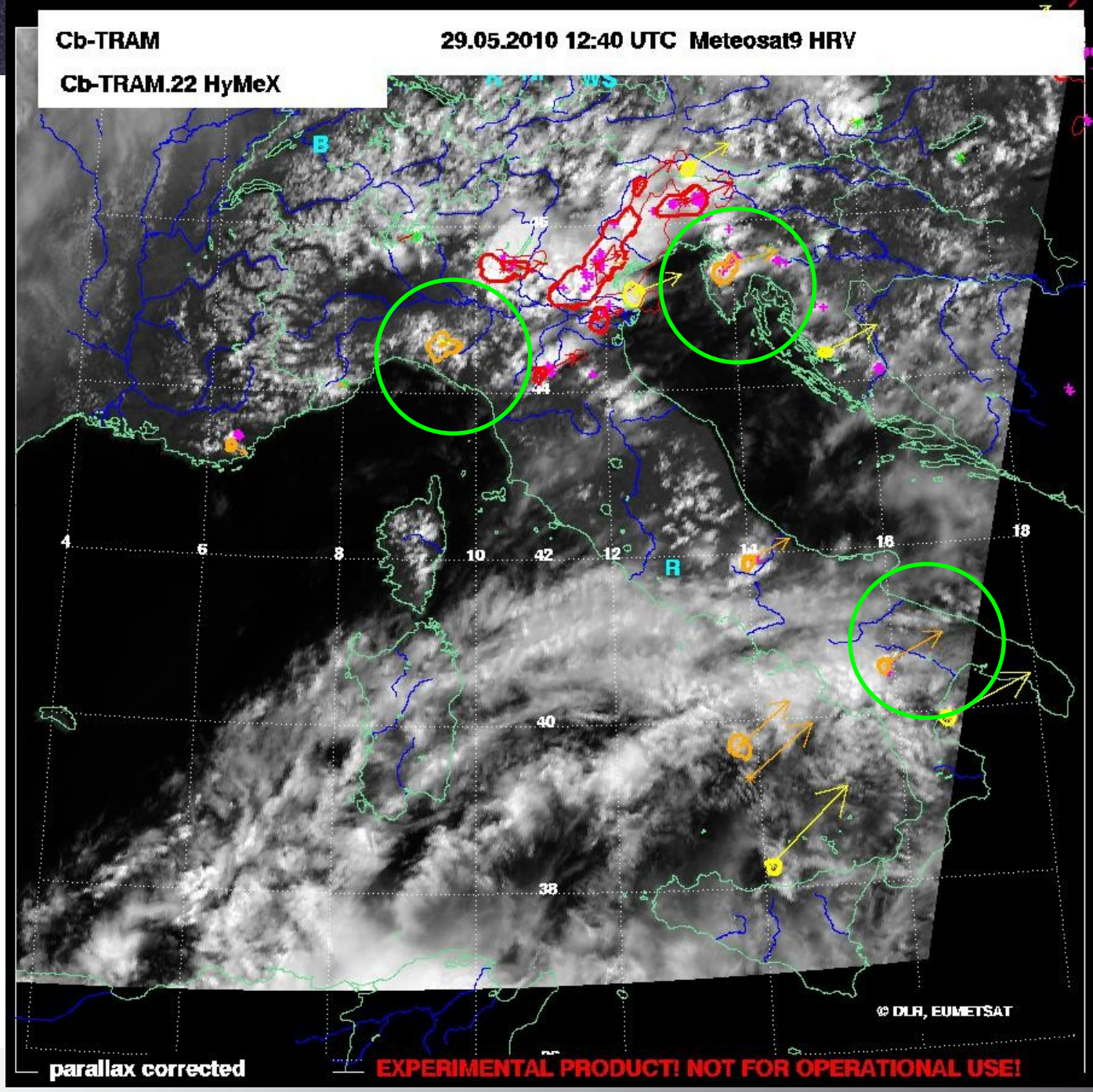

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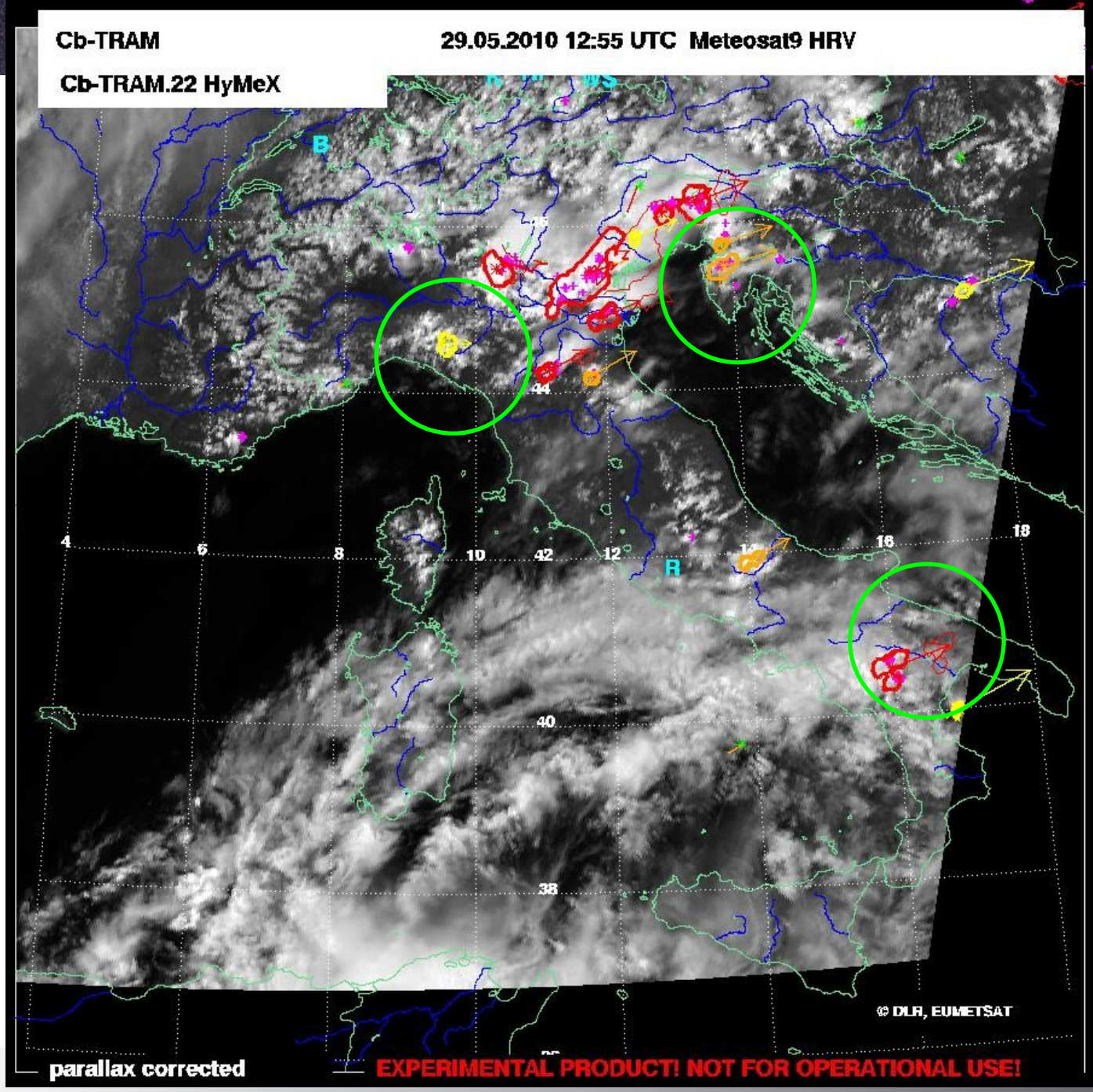

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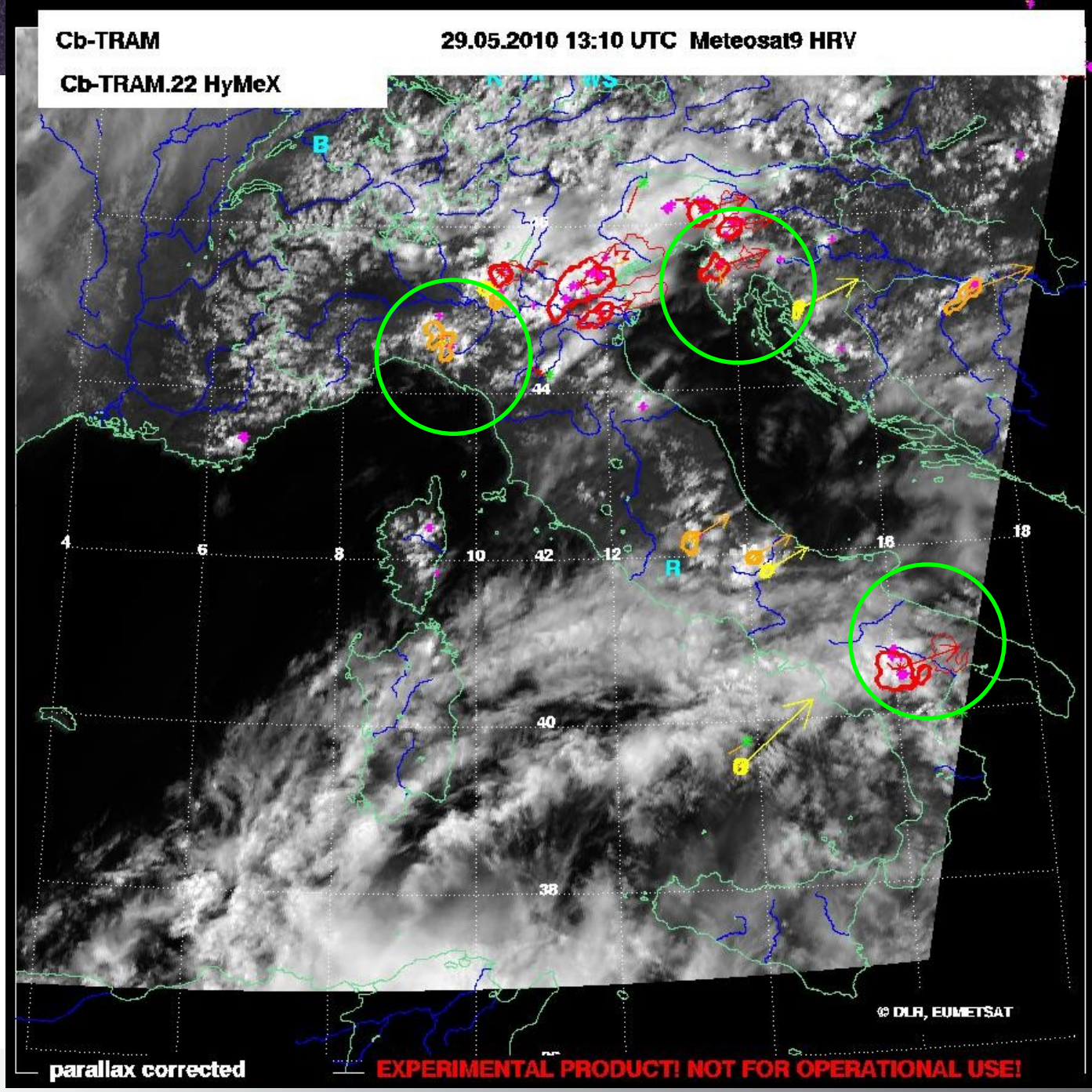

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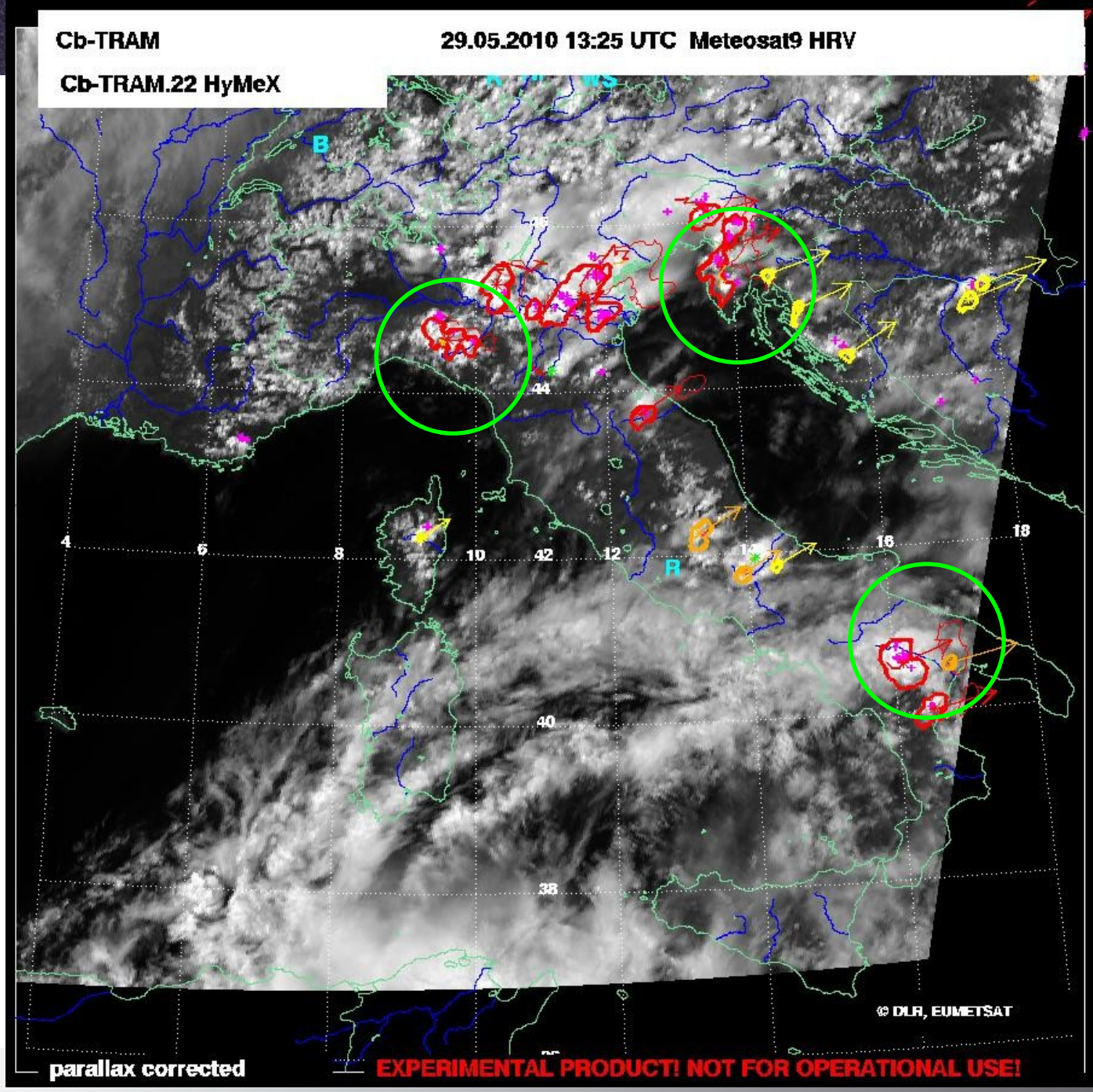

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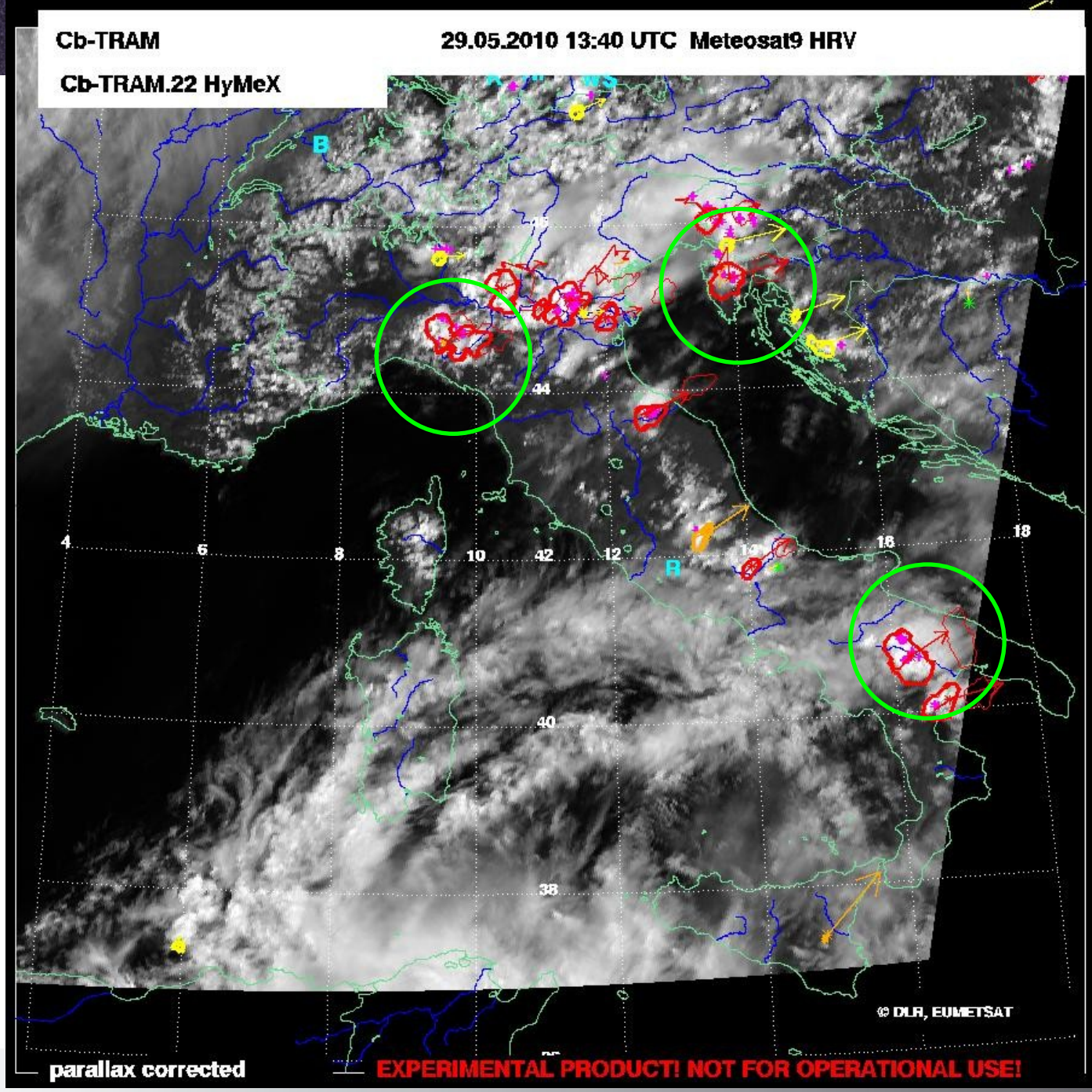

29 May 2010

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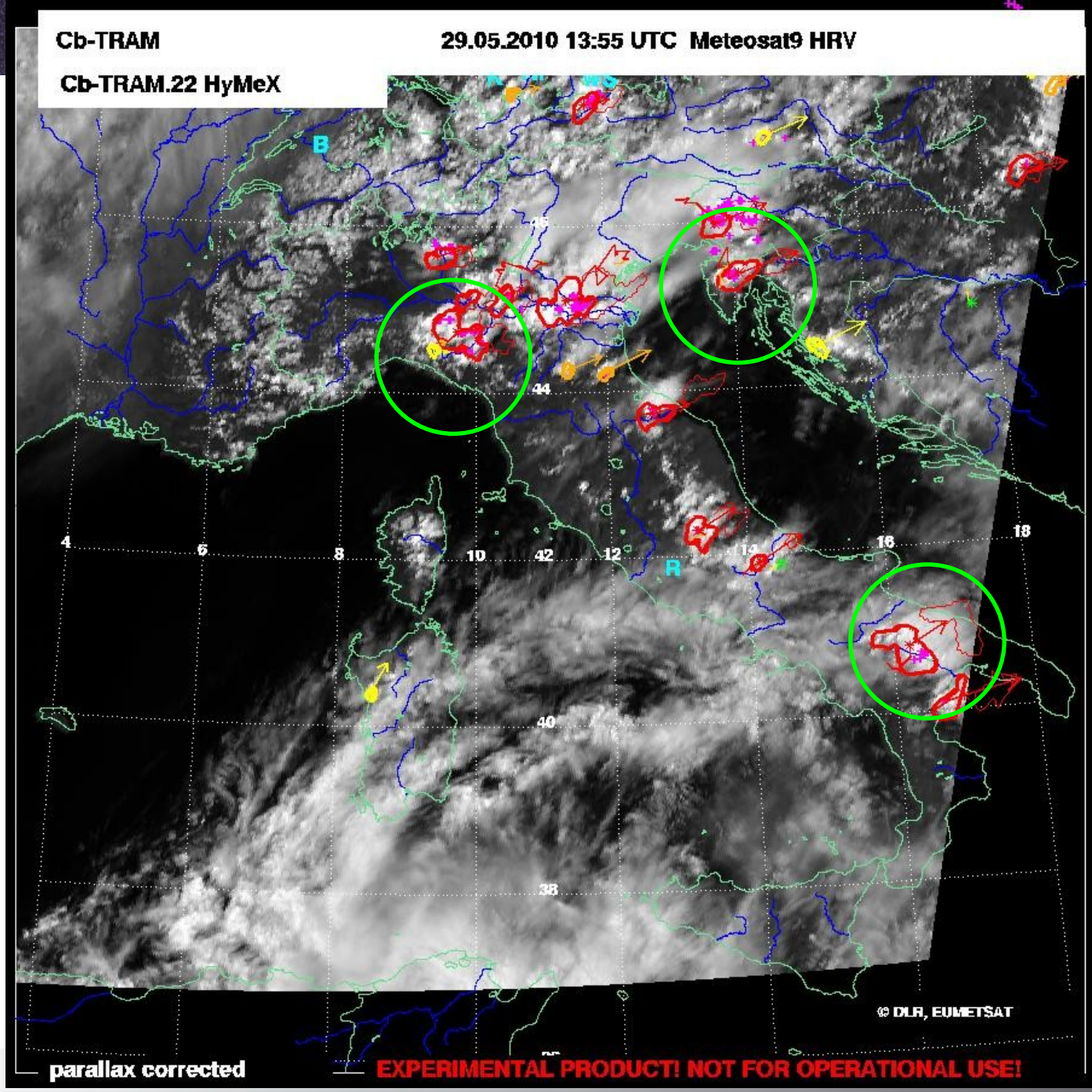
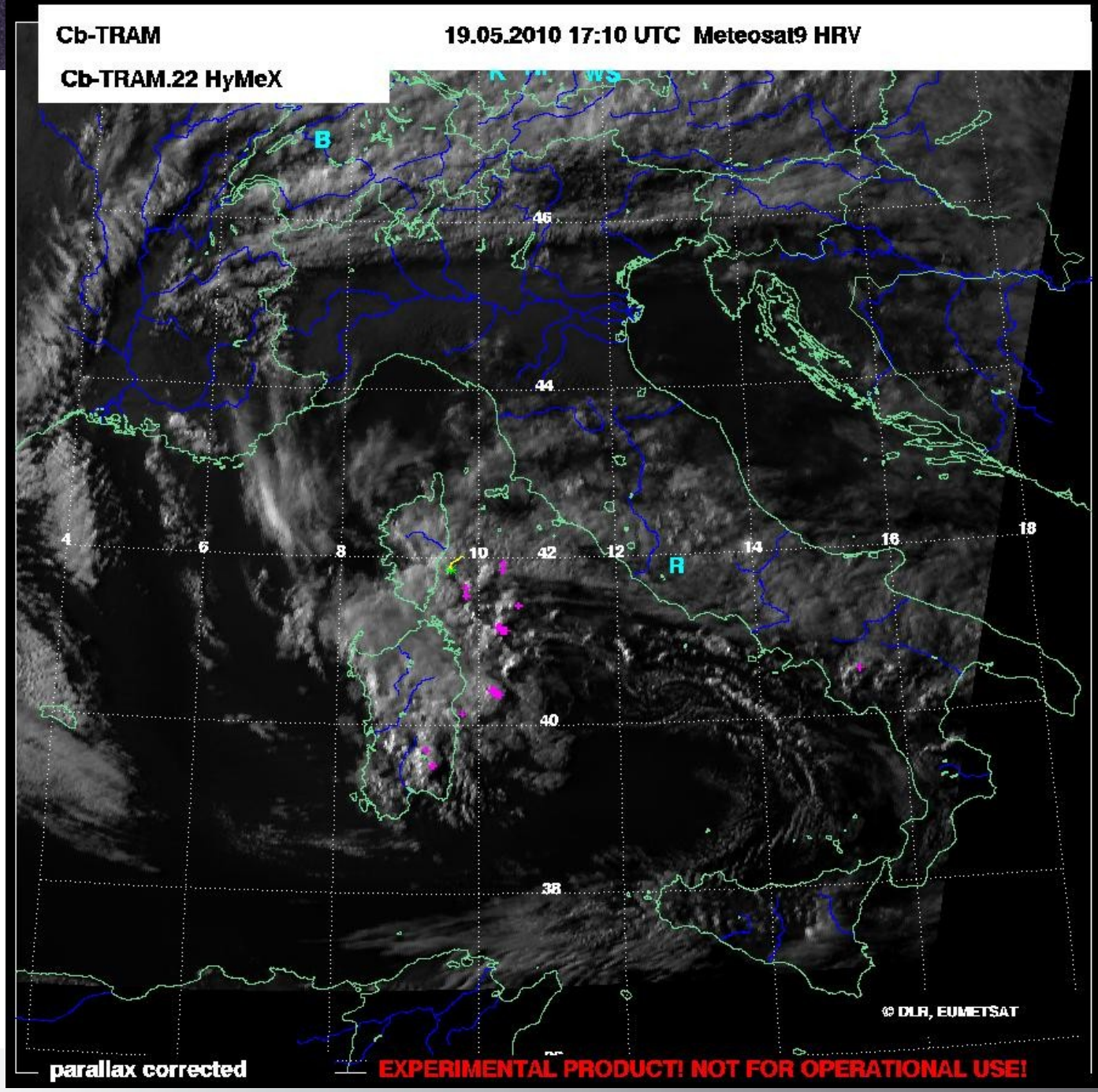


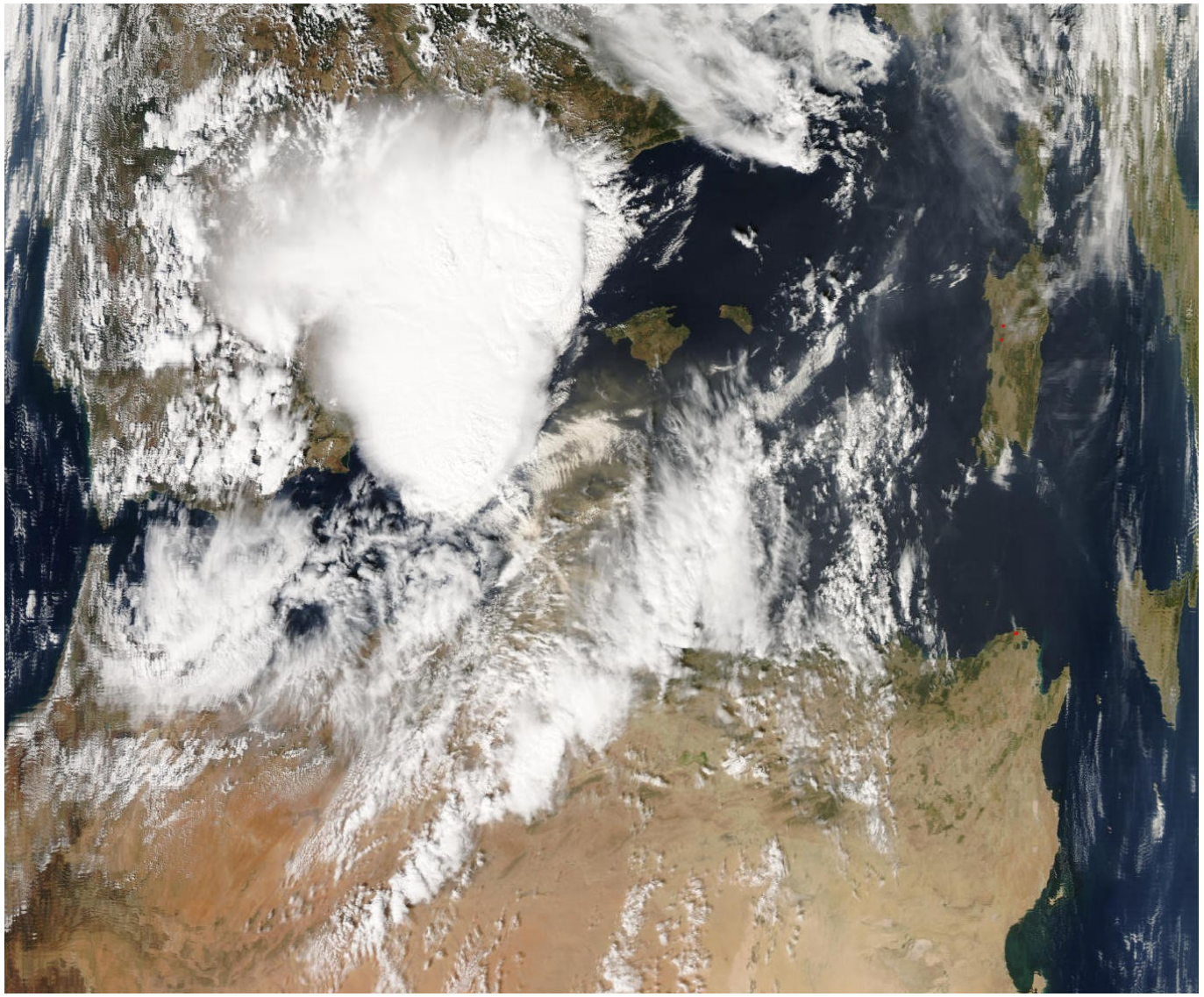
Lee cyclone
19 May 2010

Cb-TRAM contours:
initiation
rapid growth
mature
60 min nowcast
(thin red lines)

++ lightning obs
LINET (nowcast GmbH)



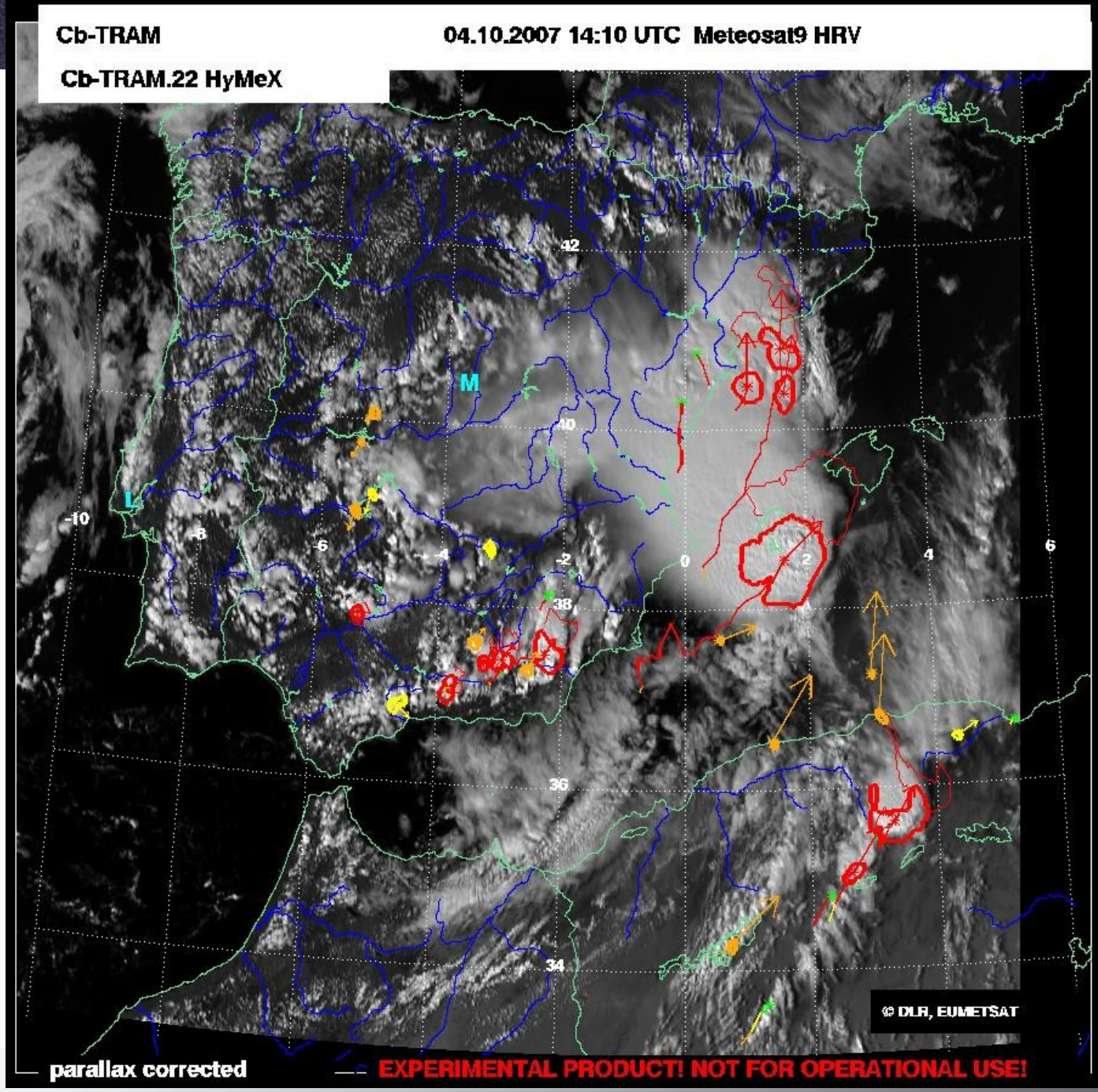
Mallorca storm
4 October 2007



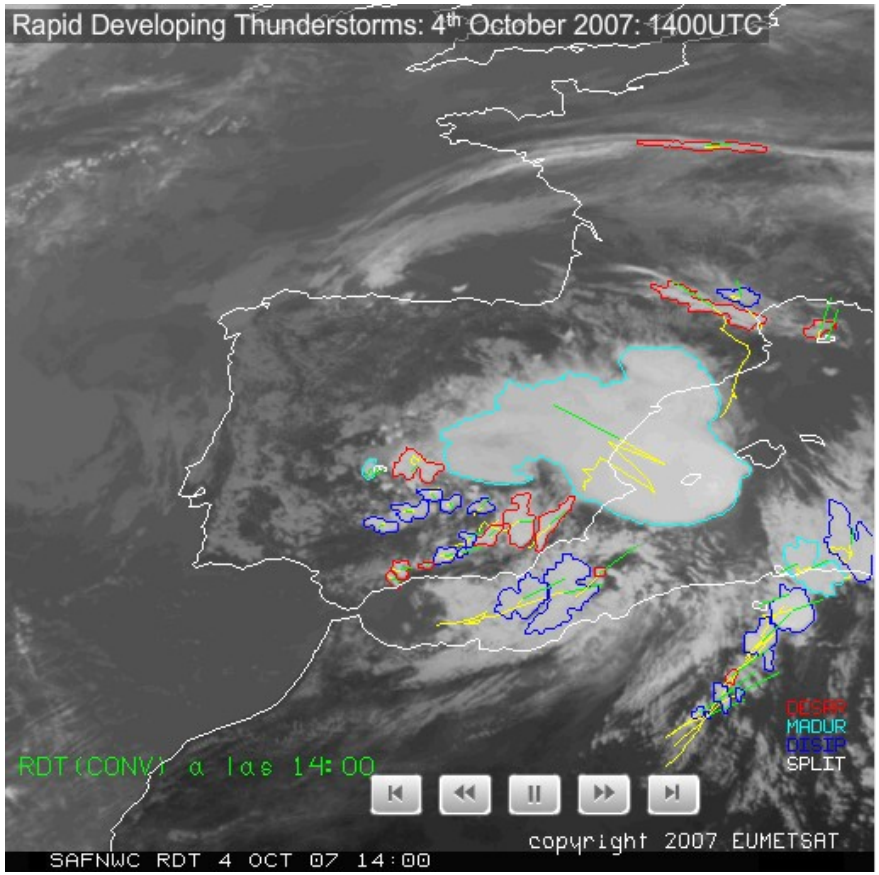
Aqua Modis 1300 UTC

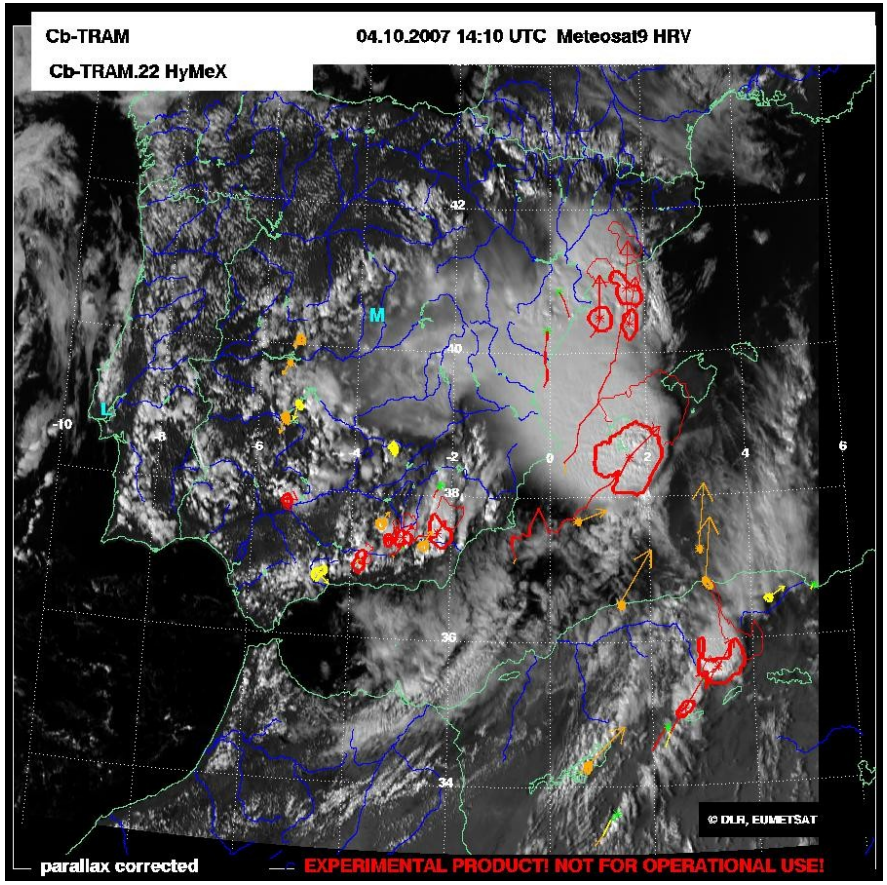
Mallorca storm
4 October 2007

Cb-TRAM contours:
initiation
rapid growth
mature
60 min nowcast
(thin red lines)



Mallorca storm 4 October 2007

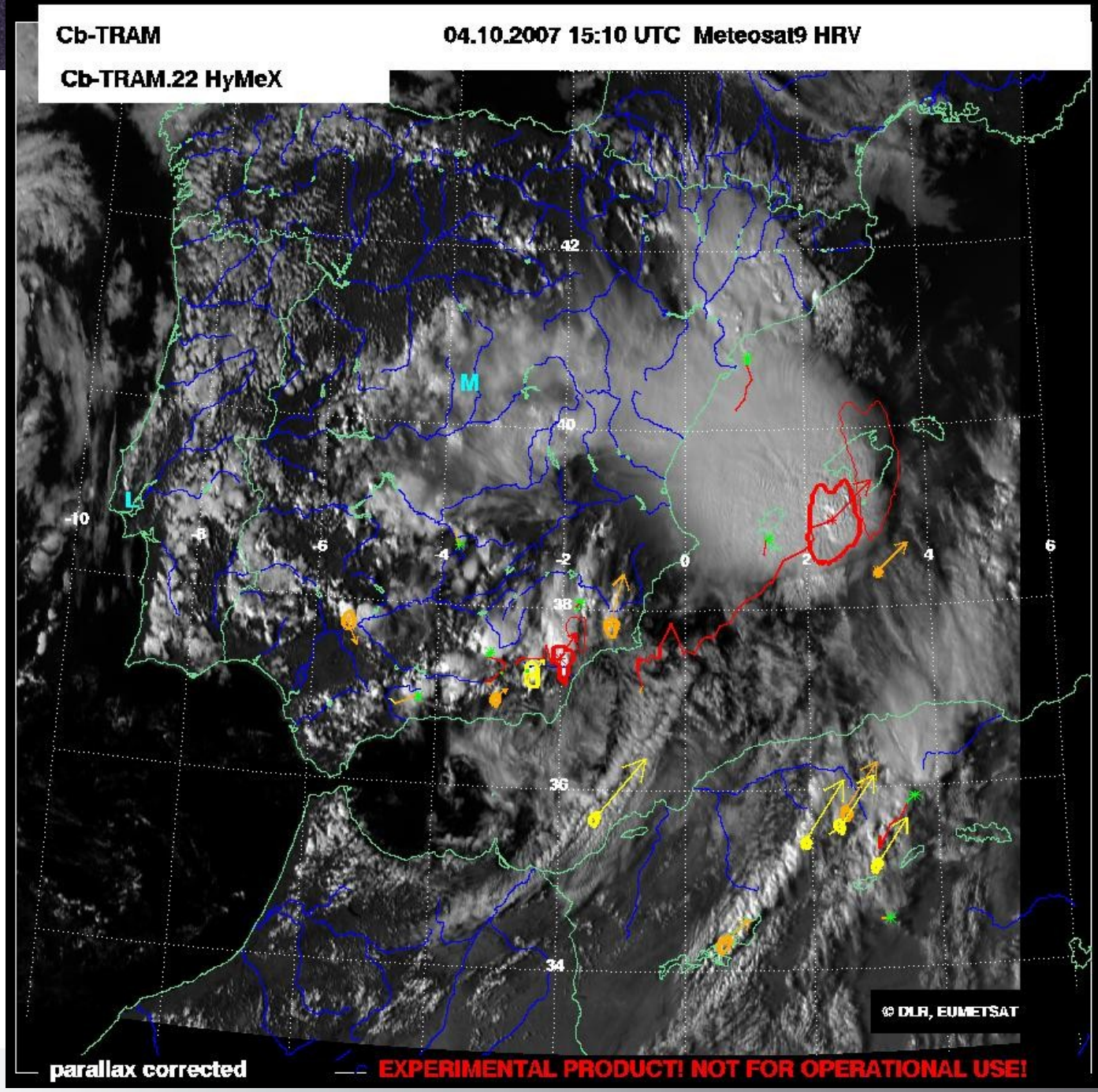




RDT (Meteo France)
developing
mature
dissipating

Cb-TRAM
initiation
rapid growth
mature

60 min nowcast
for Mallorca



Mallorca storm
4 October 2007

Cb-TRAM contours:
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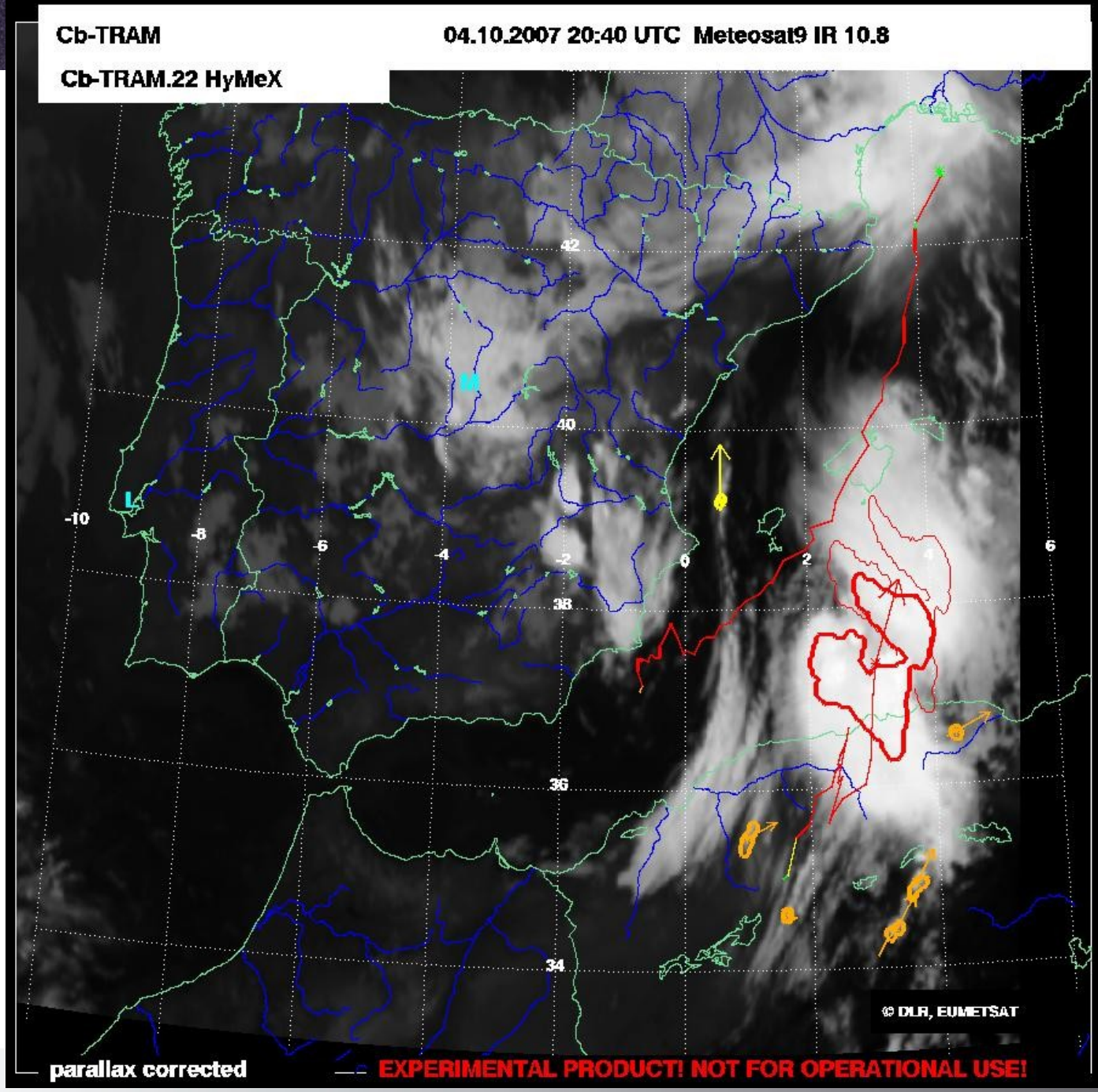

Mallorca storm
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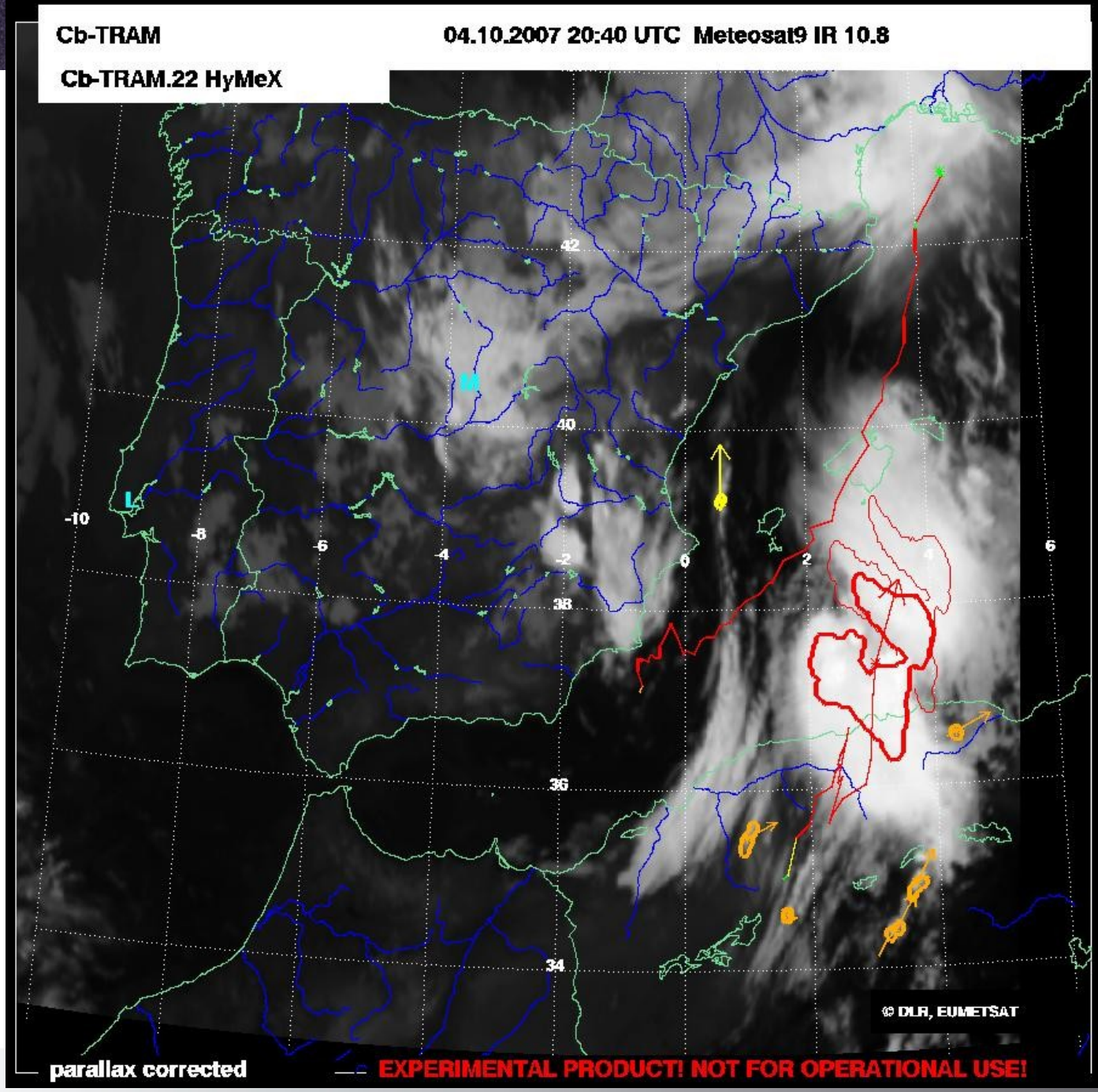

Summary

- Results suggests that Cb-TRAM is capable of detecting, tracking and nowcasting severe convective clouds over the Mediterranean
- It runs in real time, also with Meteosat rapid scan data (5 min refresh)
- Is able to distinguish active cores in thunderstorm complexes
- For the Mallorca storm the devastating cell was tracked for 14 hours
- Runs also with synthetic Meteosat data from numerical forecasts --> useful for choosing best forecast out of an ensemble (in real time)
- Could provide a valuable tool for heavy precipitation studies in HyMeX

References:

Kober, K. and Tafferner, A. Tracking and Nowcasting of convective cells using remote sensing data from radar and satellite. Subm. to Meteor. Z., 2008

Zinner, Mannstein, Tafferner, 2008:

Tracking and monitoring of severe convection (Cb) from onset over rapid development to mature phase using multi-channel Meteosat-8 SEVIRI data.

Meteorol. Atmos. Phys., 101, 191-210

Zinner and Betz, 2009: Validation of Meteosat storm detection and nowcasting based on lightning network data, EUMETSAT 2009 Proceedings, Bath, United Kingdom 21 - 25 September 2009