SAF Nowcasting
Product Assesment Review
Worshop (Madrid 17-19 October 2005)

PGE 11

Rapid Development Thunderstorm

Status, Validation, Perspectives

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EUMETSAT

METEO FRANCE
Toujours un temps d'avance

Plan

➢ **Research activity** *(visiting scientist: Oleksiy Kryvobok)*

  ▪ Use of other PGEs and HRVis for RDT improvement

➢ **Tuning PGE11 satellite-based discrimination using SEVIRI data**

➢ **Long duration validation of RDT v1.2 release**

➢ **Perspectives**

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Long duration validation of PGE11

Research activity

(Visiting Scientist)

➢ **Use PGE output : PGE06 (TPW), PGE07 (LPW), PGE08 (SAI), PGE12 (AMA)**

- ▪ To improve discrimination skill of RDT with stability and water vapor information
  - As a mask in order to focus on the interest areas
 - Or as additional discrimination parameters

➢ **Monitoring characteristics of young convective clouds using HRVIS data**

- ▪ To improve the precocity of detection *(Sub-pixel detection)*
- ▪ To correct for partial pixel filling in cloud cooling rate estimation

➢ **Results: Much work needed before implementation**

- ▪ PGEs 06, 07, 09 and 12

  An overview of PGEs qualities, version V.0.1, stop the study

- ▪ Sub-pixel approach

  Major improvements are necessary on reflectance processing
  - ▪ Clear sky reflectance map at HRVIS resolution and/or
  - ▪ More accurate 3-D radiative transfer for estimation of cloudy reflectance (small and edge cloud)

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Tuning PGE11 Satellite-Based Discrimination using SEVIRI data

➢ **Reminder : Principle of the satellite-based discrimination**
  - Multi-level segmentation (3 levels)
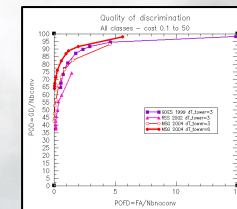 - Best discrimination parameter chosen independently for each final class
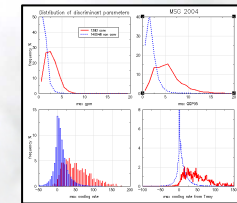
➢ **Initial results**
  - Similar to Rapid Scan for low cost ratio
    (cost ratio = False Detection unit cost / Non Detection unit cost)

  - Poorer than results for GOES data (despite closeness in spatial resolution)
    Interpretation: Cells first detected at cold temperature are too numerous with MSG

➢ **Adaptation of detection method to MSG data**
  - Minimum cloud tower height $\Delta T_{tower} = 6°C$
    - Improves matching with lightning flashes
    - Reduce number of cells first detected at cold temperature

  - Electrical filter: focus on cell with strong electrical activity
    - Discard non convective cloud labelled as convective due to lack of accuracy of lightning flashes matching

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Long duration validation of PGE11

Long Duration Validation

➢ **Overall quality of discrimination**

- Overdiscrimination on the learning data set
- Variability of the discrimination skill with the period of year (poor for cold period)
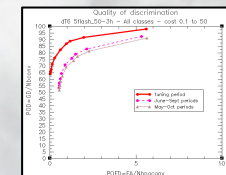- Link between electrical activity and discrimination skill
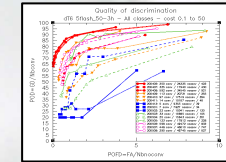
➢ **Precocity of the discrimination**

- Half of convective systems are diagnosed as convective before their strong electrical activity occurrence.
- Around 80% of clouds cells are diagnosed as convective no later than 30 minutes after the first flash occurrence

➢ **Conclusion**

- The quality of discrimination during summer period is better with V1.2 and MSG data than with GOES
- Cold periods show low probability of detection (POD).
- It is recommended to use RDT with lightning flashes and filters of convective systems
  - Improve score of POD (necessary for cold period)
  - Remove long duration trajectories without interest

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Long duration validation of PGE11

Perspectives (short and medium term)

➢ **Improve population definition**

▪ Better separate developing thunderstorm from mature system
- To build an homogenous population of convective cloud
- To focus on RDT main purpose (developping TS)
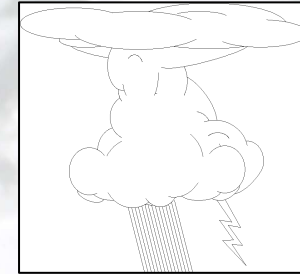
➢ **Examine various ground truth**

For improving quality of the learning sample

- Data independent from satellite: lack of accuracy in matching method generates noise in learning data set
- Satellite data (e.g. cooling rate):
  - lack of direct link with sensible weather
  - provide an efficient tuning on area without ground observation network

➢ **Change the discrimination method**

▪ Reduce final classes number for removing overdiscrimination
Classify mainly using minimal temperature reached

▪ Discard multilevel segmentation and build discrimination on principal component and factorial analysis
- Introduce additional promising discrimination parameters
- Better combine discrimination parameters

Long term perspectives
(not all will be covered)

➢ Better use Cloud Mask for early detection

➢ Reconsider using other PGEs as input for better discrimination,

➢ Or rather consider **convection-related diagnostic from mesoscale assimilation** at high refresh rate (< 3h) : boundary layer moisture supply, middle-level dryness, CAPE from most unstable level, DCAPE, low-level convergence, upper-level forcing

➢ Improve precocity if Cloud Mask improved to HiRes

➢ Test RDT algorithm for Upper-Level-Dynamic monitoring : tracking dry cores in WV, high value cores in O3 product

Thanks for your attention
Time for comments, requests, discussion …

Quality of discrimination
All classes – cost 0.1 to 50

POD=GD/Nbconv

- ■ GOES 1999 dT_tower=3
- ▲ RSS 2002 dT_tower=3
- ○ MSG 2004 dT_tower=3
- ● MSG 2004 dT_tower=6

POFD=FA/Nbnoconv

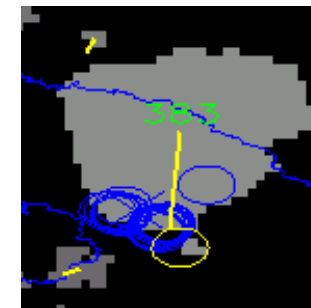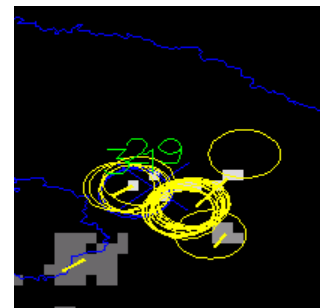# Adaptation of detection method with MSG data: $\Delta T_{tower}= 6°C$

Characteristics of convective trajectories start. MSG(left) and GOES (right) cases : $\Delta T_{tower}= 3°C$

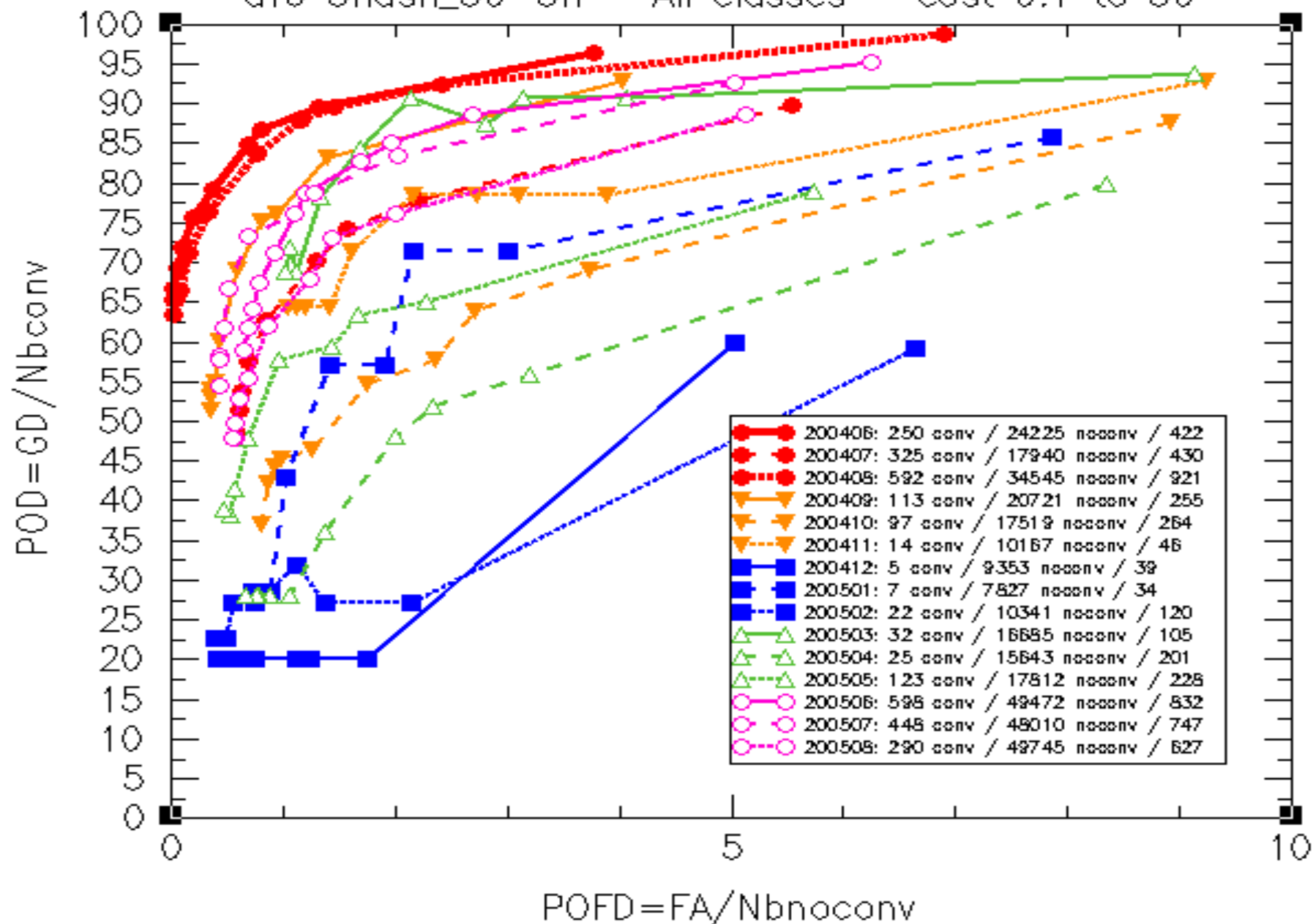Minimum Temperature at trajectory birth

- GOES 1999
- MSG 2004 dT3

frequency %

minimum temperature
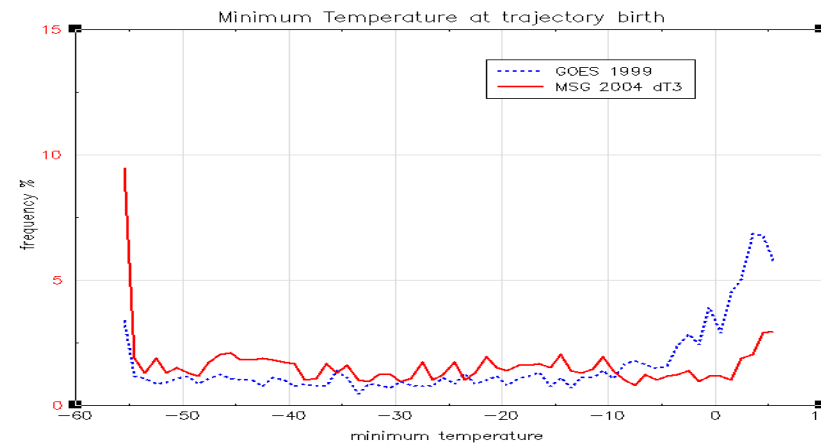
Lightning flashes pairing with MSG

$\Delta T_{tower}= 3°C$ (left) and $\Delta T_{tower}= 6°C$ (right)

Quality of discrimination
dT6 5flash_50-3h – All classes – cost 0.1 to 50

POD=GD/Nbconv (vertical axis)
POFD=FA/Nbnoconv (horizontal axis)

Legend:
- 200406: 250 conv / 24225 noconv / 422
- 200407: 325 conv / 17940 noconv / 430
- 200408: 592 conv / 34545 noconv / 921
- 200409: 113 conv / 20721 noconv / 255
- 200410: 97 conv / 17519 noconv / 264
- 200411: 14 conv / 10167 noconv / 46
- 200412: 5 conv / 9353 noconv / 39
- 200501: 7 conv / 7827 noconv / 34
- 200502: 22 conv / 10341 noconv / 120
- 200503: 32 conv / 16685 noconv / 105
- 200504: 25 conv / 15843 noconv / 201
- 200505: 123 conv / 17512 noconv / 228
- 200506: 595 conv / 49472 noconv / 832
- 200507: 445 conv / 48010 noconv / 747
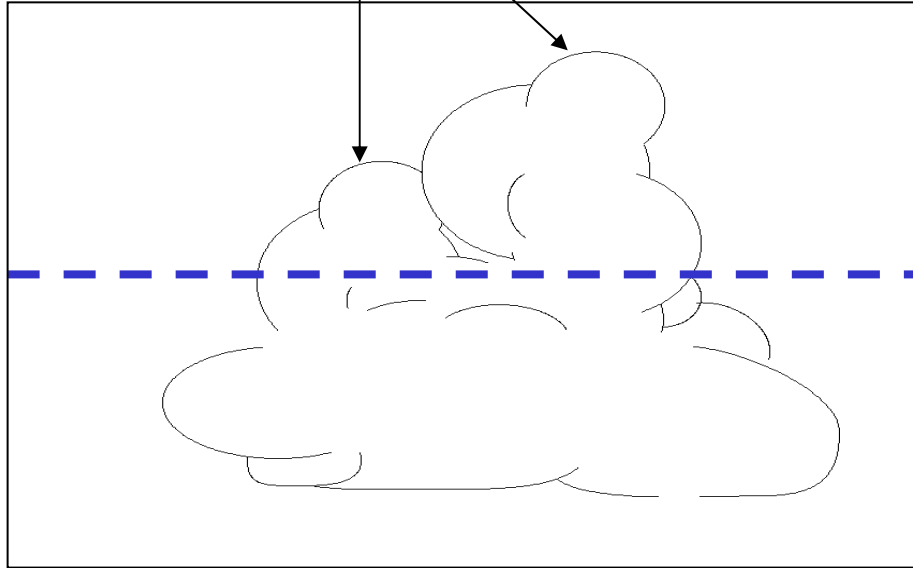- 200508: 290 conv / 49745 noconv / 627

Quality of discrimination

dT6 5flash_50-3h — All classes — cost 0.1 to 50

Bubblings are depicted, but not individually tracked

Highest vertical development for defining tracked cells and attempting discrimination, either :

- **fixed temperature (parameter T_{cold}) ~ –30°C,**

- **tropopause related temperature**

- **Cloud Type « high & thick cloud » diagnostic**

- **brightness difference with water vapor channel**