Impact of IASI assimilation in convective scale model AROME

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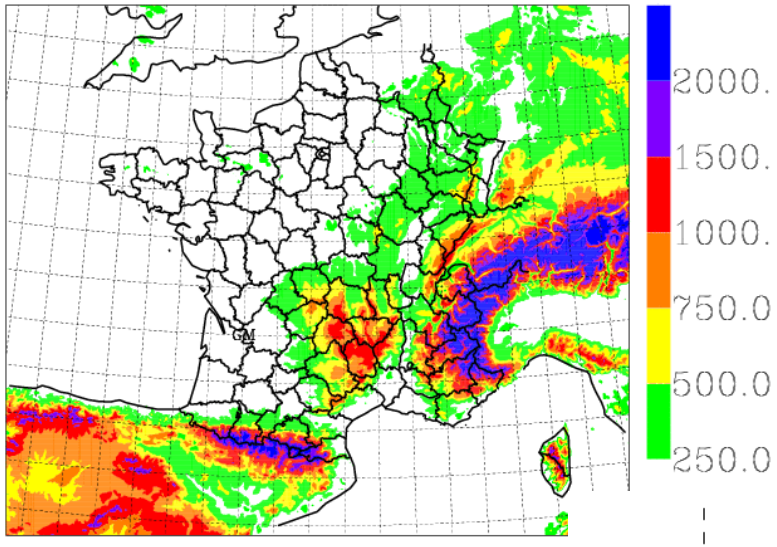
Overview

- 1. What is AROME ?
- 2. IASI in next operational AROME
- 3. Increasing IASI density in AROME

1. What is AROME ?

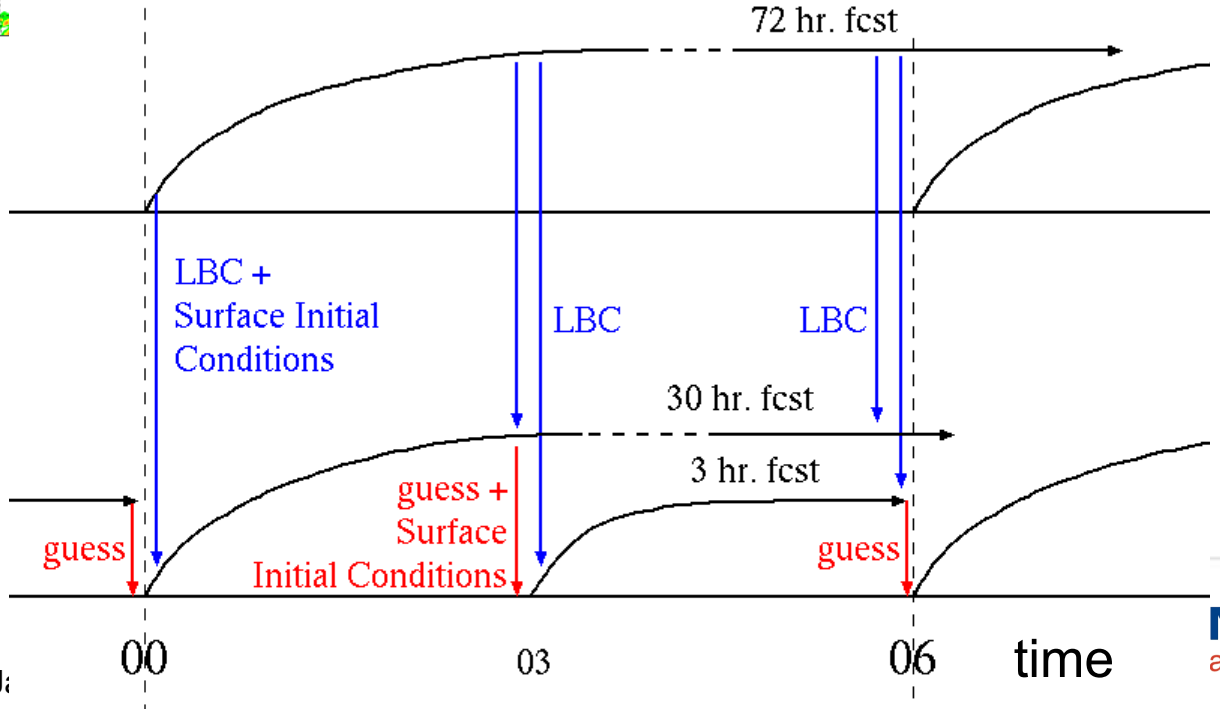


AROME France domain:
2.5 km mesh
60 vertical levels up to 1hPa

AROME is operational since December 2008

ARPEGE cycle

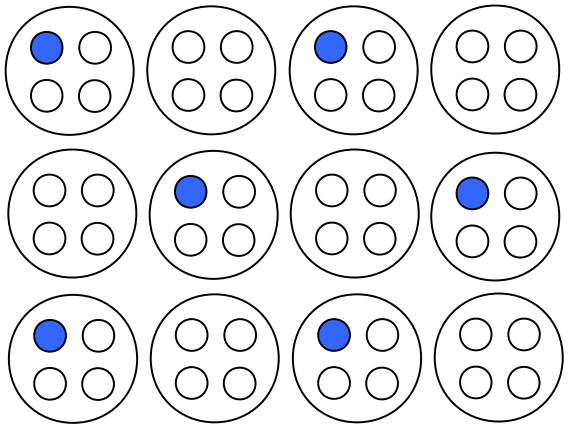
AROME cycle

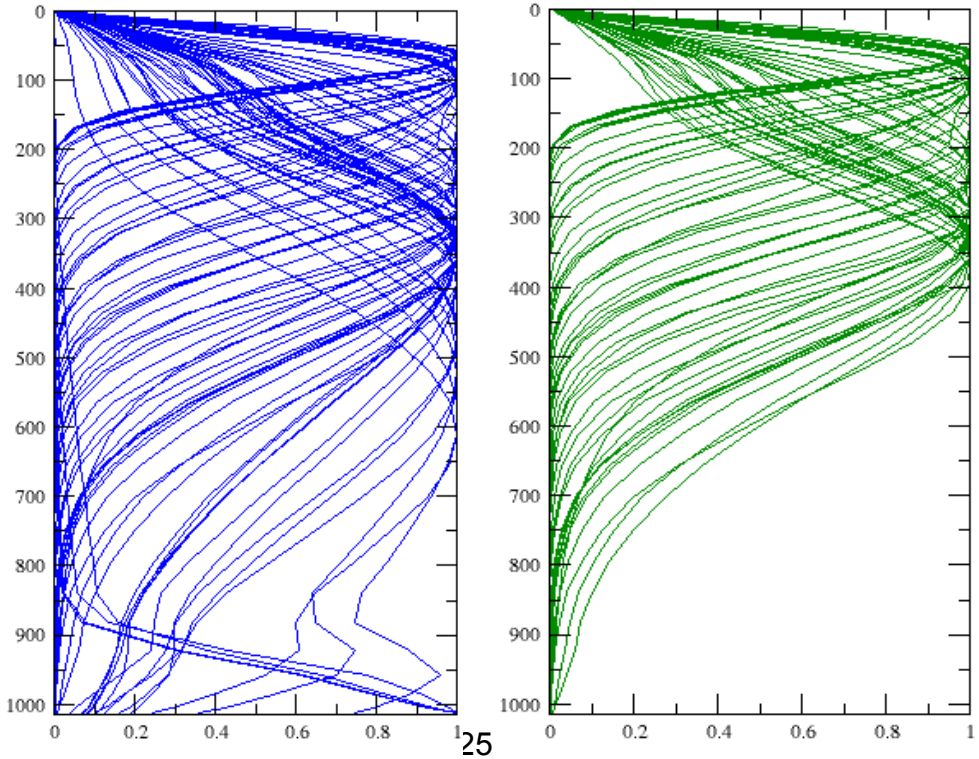


NCE avance

2. IASI in next operational version of AROME

- Pre-selection:
  - Only data from detector #1
  - Pattern depending on scanline→
- Geographical thinning: 1 prof. / 125km

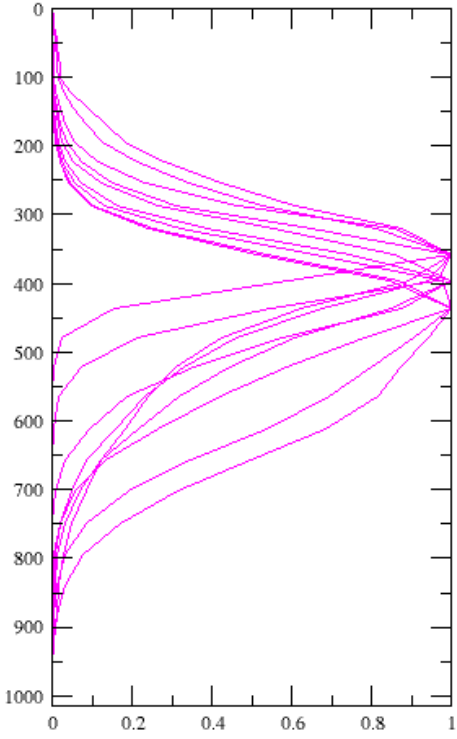




9 WV

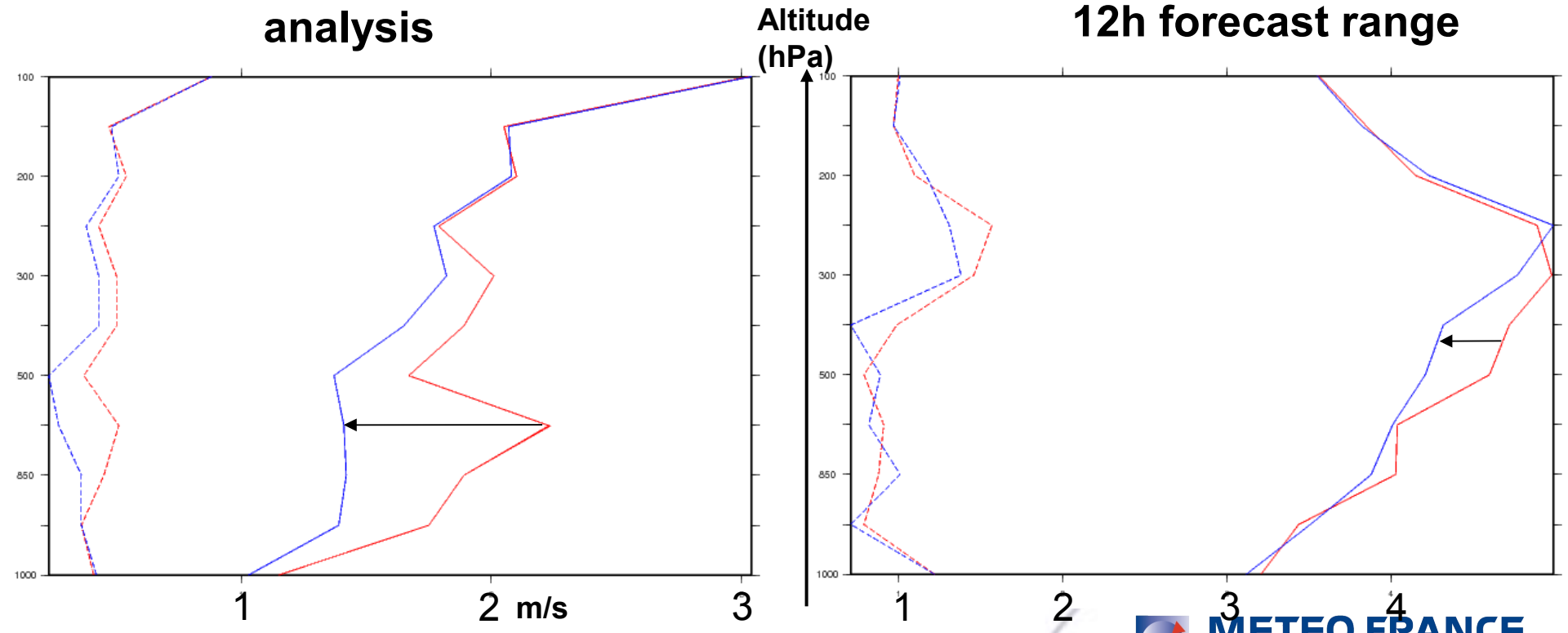
channels

LW - T
68 over sea
50 over land



2. Impact of IASI when preparing next operational of AROME

- **Impact on wind field**
  biases (dashed) and RMSE (solid) wrt radiosoundings
  reference (**no IASI, in red**), first attempt (**with IASI, in blue**)
  averaged over a 3-week period in May 2009



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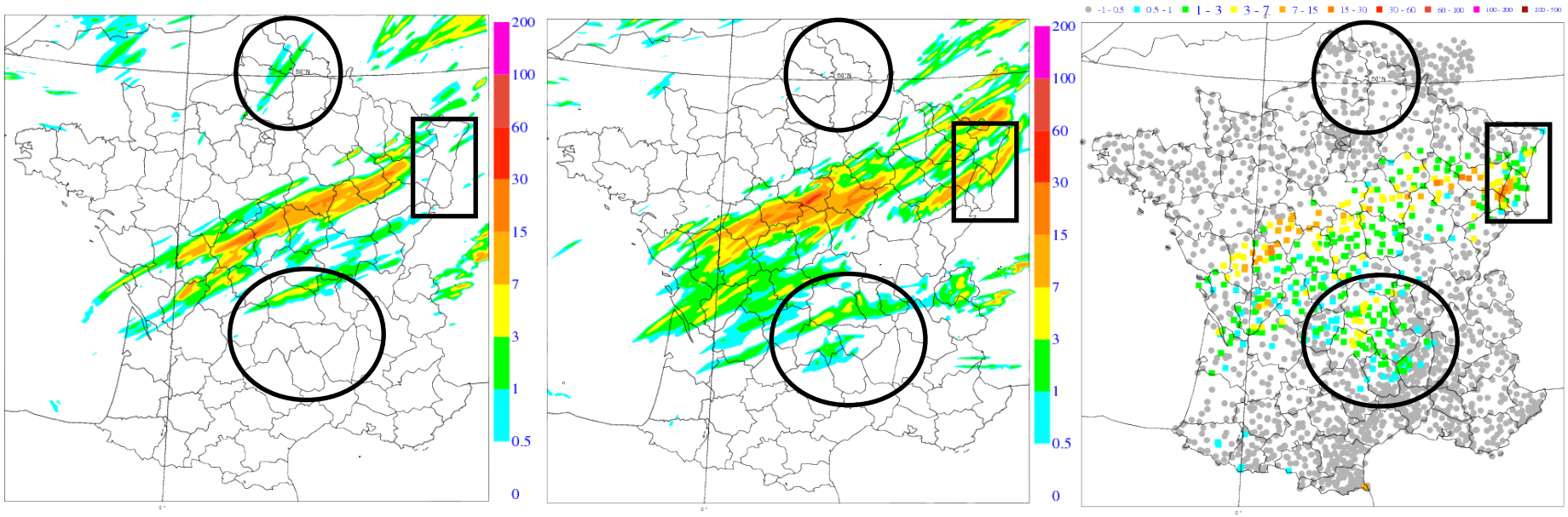
2. Impact of IASI when preparing next operational of AROME

- **Impact on precipitation prediction**
  example of 12h precipitation between 00 and 12UTC on 21 May 2009

12h forecast range



Reference: no IASI | **First step: IASI 125km** | **Verif.: Rain gauges**

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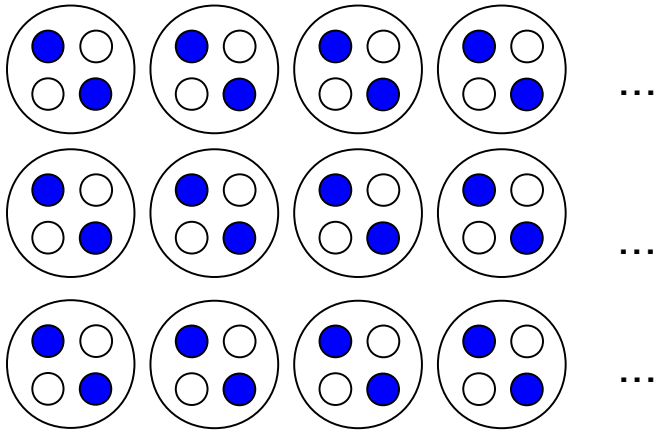
3.1 Increasing IASI density



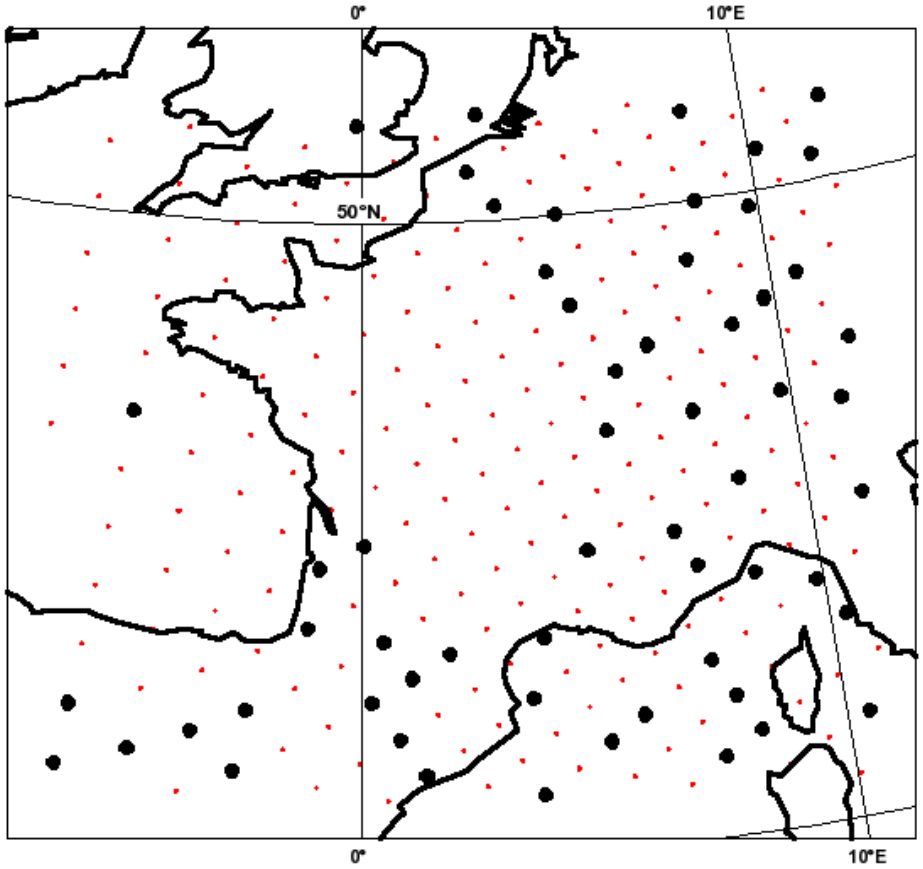
- Geographical thinning
  - Pre-selection:
    - Data from detector #1 and detector #3
    - All FOR
  - Selection during screening: 1 profile per 80km box

- Bias correction is VarBC
  - Coefficients for the regression are those computed in ARPEGE
  - Predictors: air-mass predictors are computed in AROME

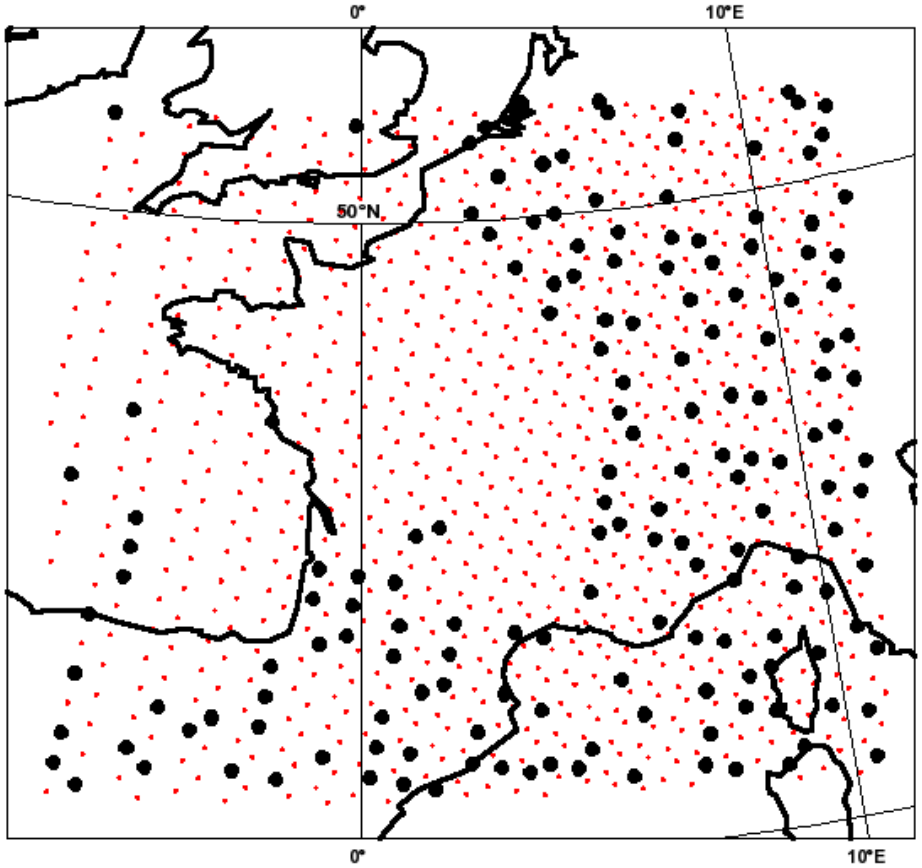
- Cloud detection: McNally and Watts (2003)

3.1 Increasing IASI density

1 fov over 8 •
125km thinning



1 fov over 2 •
80km thinning



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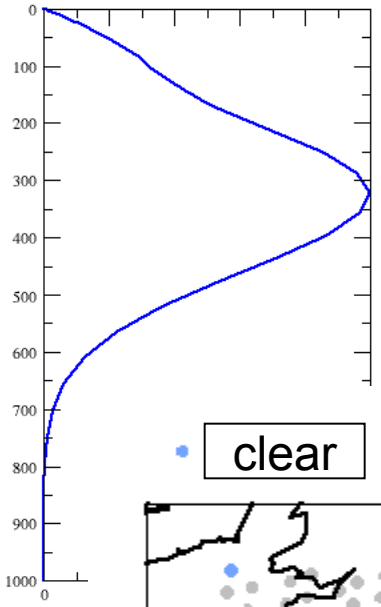
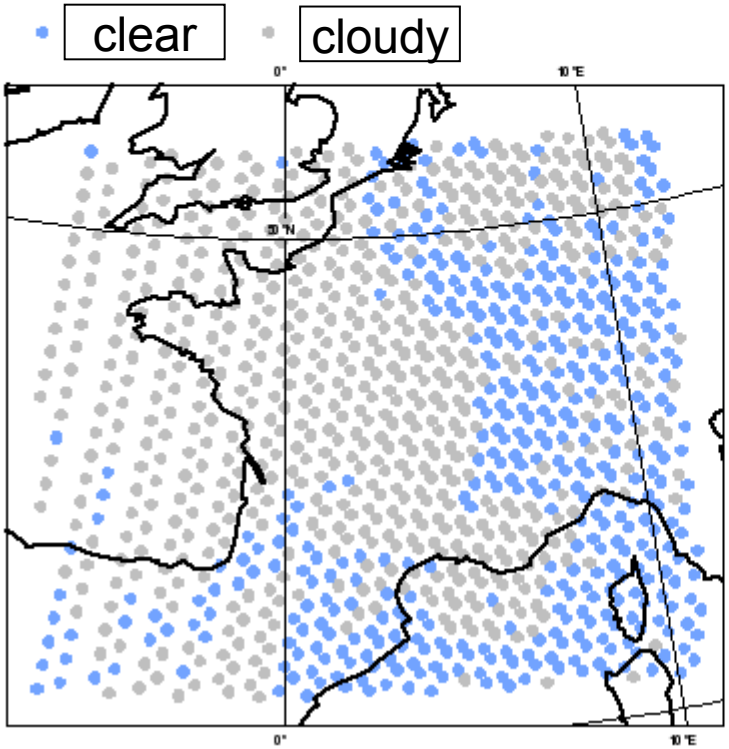
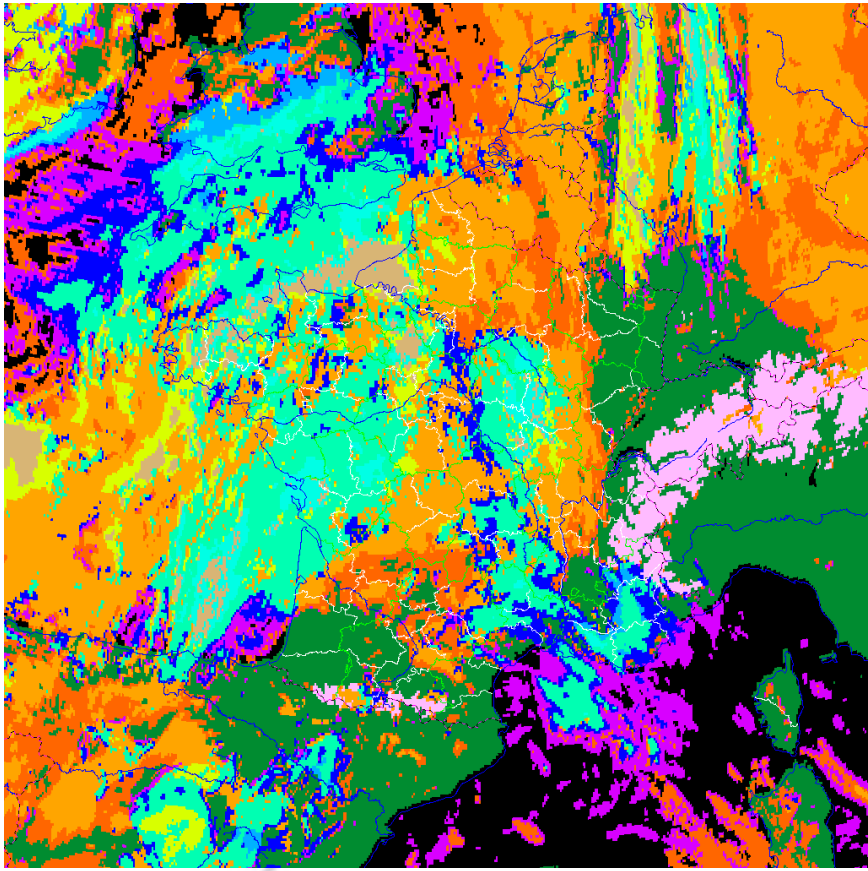
3.2 Cloud detection



Cloud flag from McNally & Watts for channel #0246



Cloud type product from Météo-France/CMS (NWP SAF)



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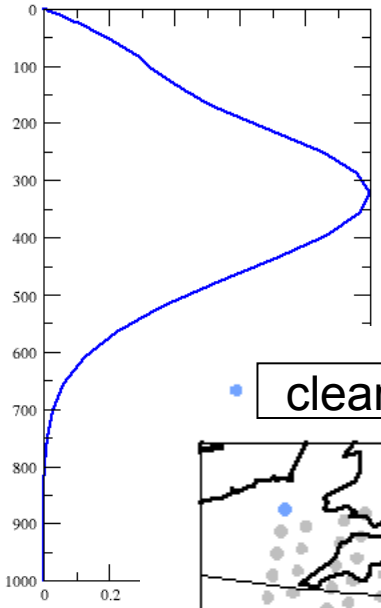
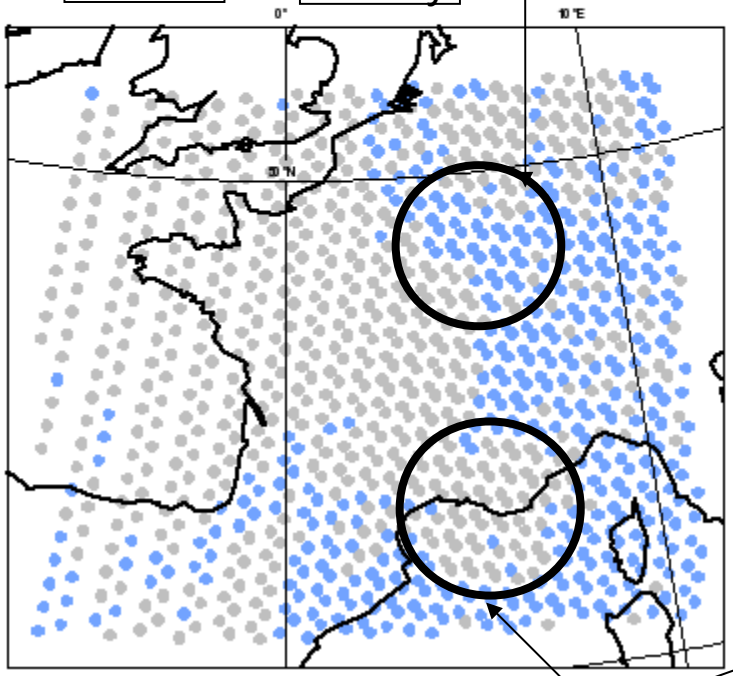


Clear /
low – very low cloud

clear cloudy



Cloud type product from
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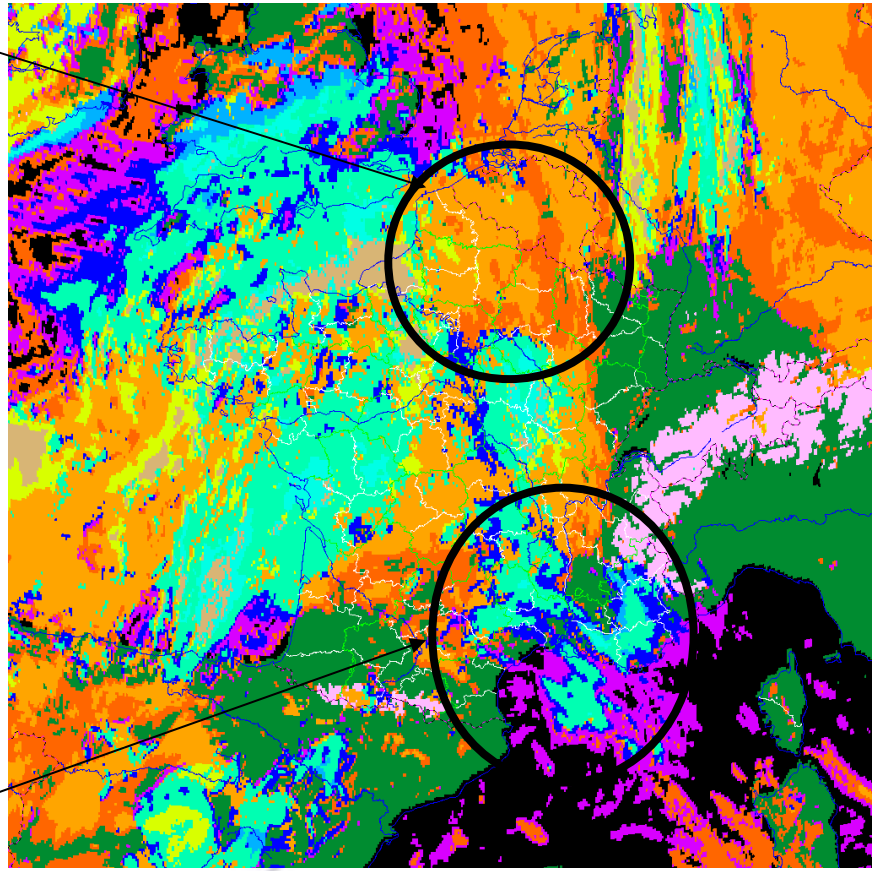

Cloud flag from McNally
& Watts for channel #0246

Cloudy /
high cloud

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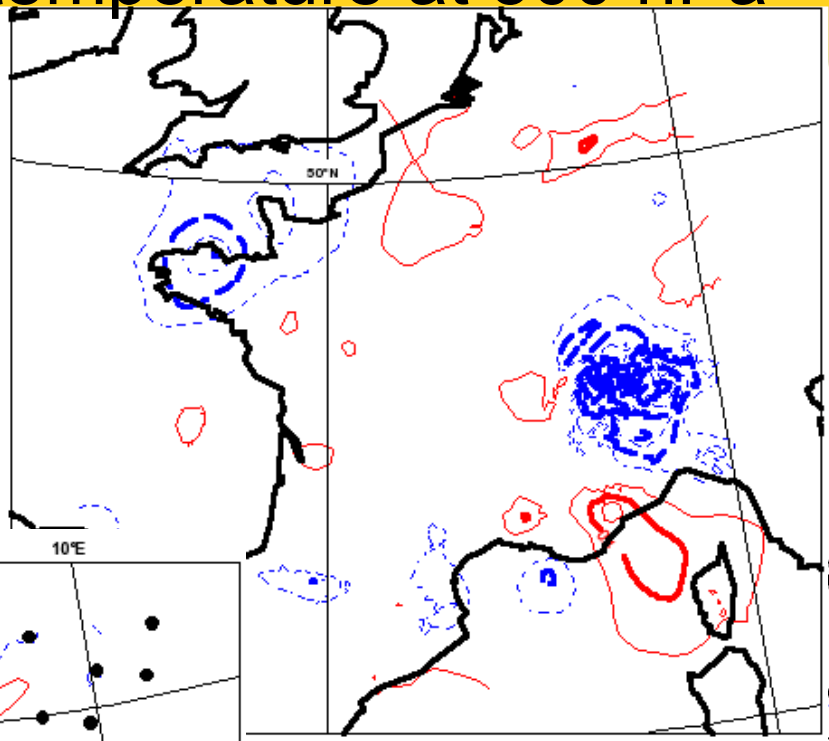
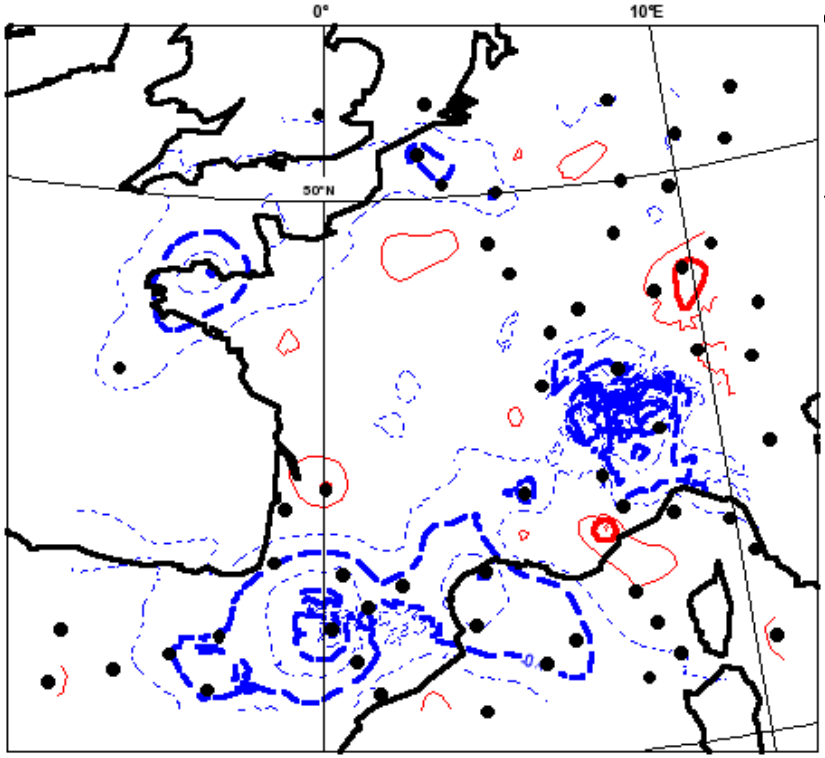
3.3 Impact on analysis increments: temperature at 500 hPa

No IASI

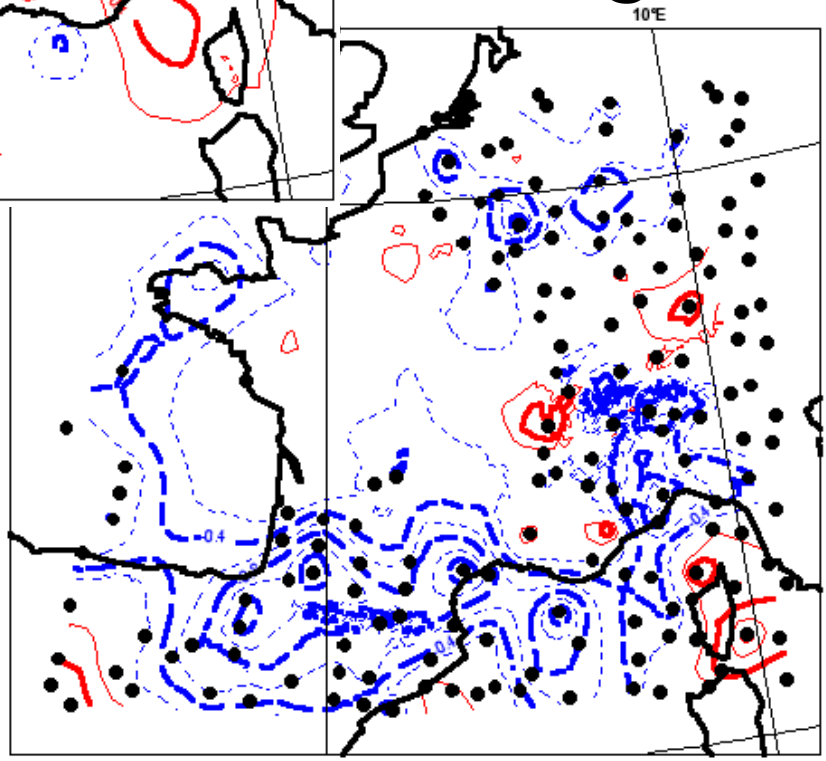


1 isoline every 0.2 K

IASI @ 125km

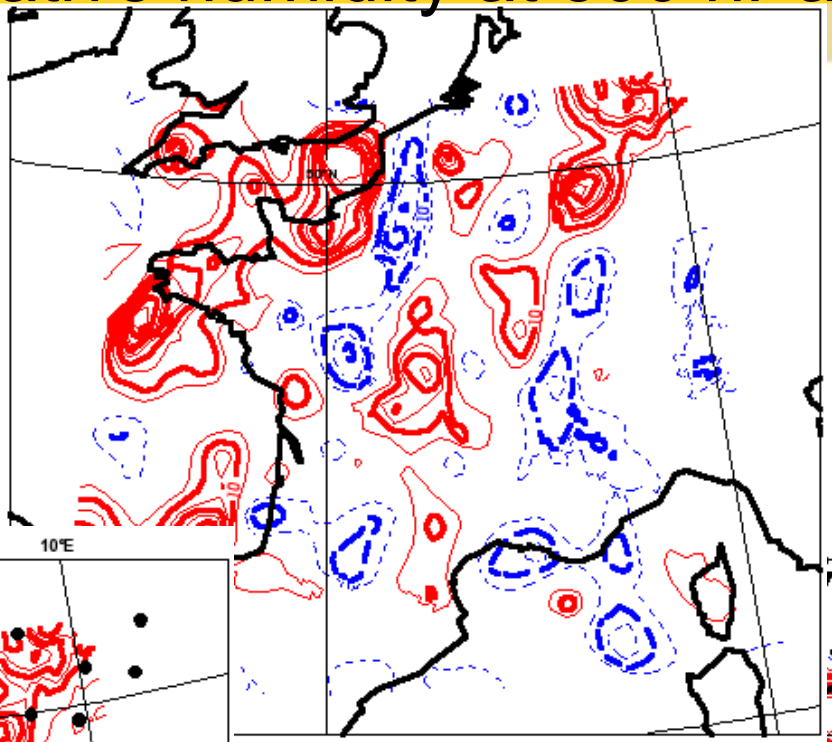


IASI @ 80km



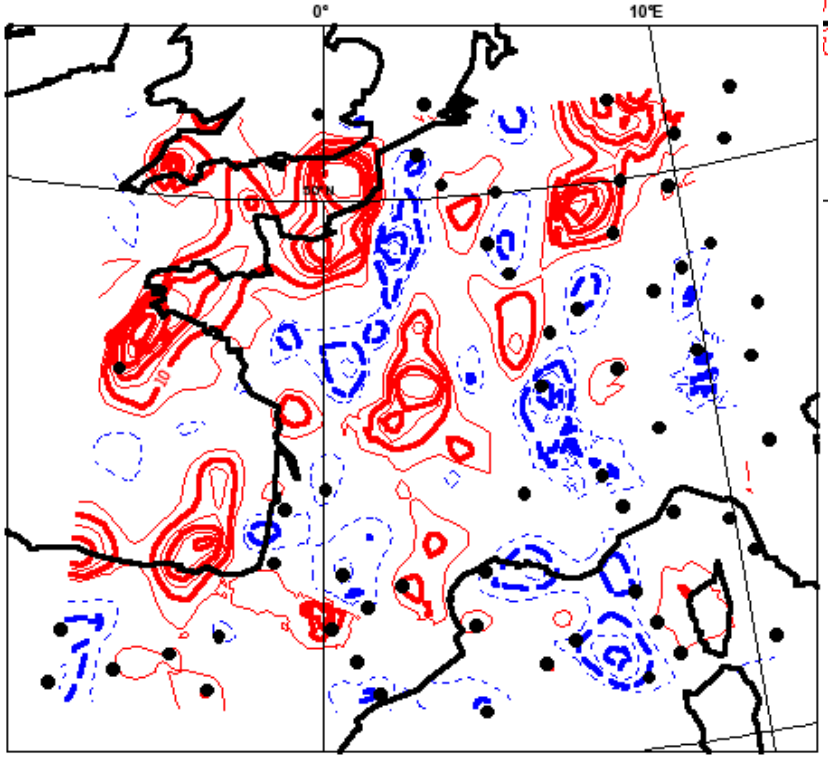
3.3 Impact on analysis increments: relative humidity at 500 hPa

No IASI

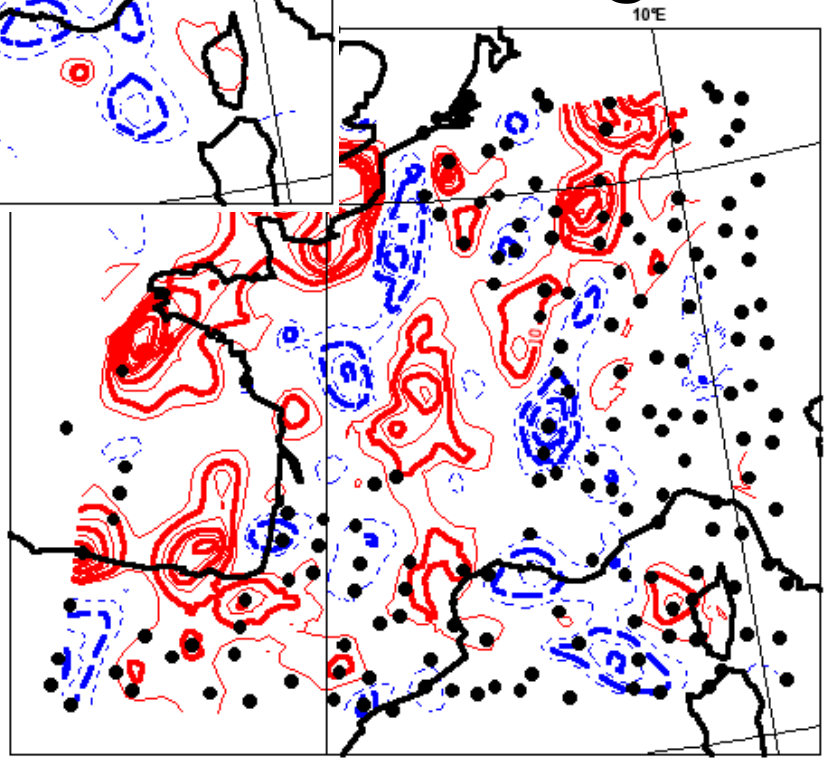


1 isoline every 5 %

IASI @ 125km



IASI @ 80km



3.4 Which impact on forecasts ?

- Since the first attempt of assimilating IASI @ 125 km, the assimilation of **radar reflectivities** has been added in AROME and they bring a lot of information.

When are the radar relectivities assimilated in AROME ?
Wattrelot et al., ERAD 2008
Caumont et al., Tellus inpress

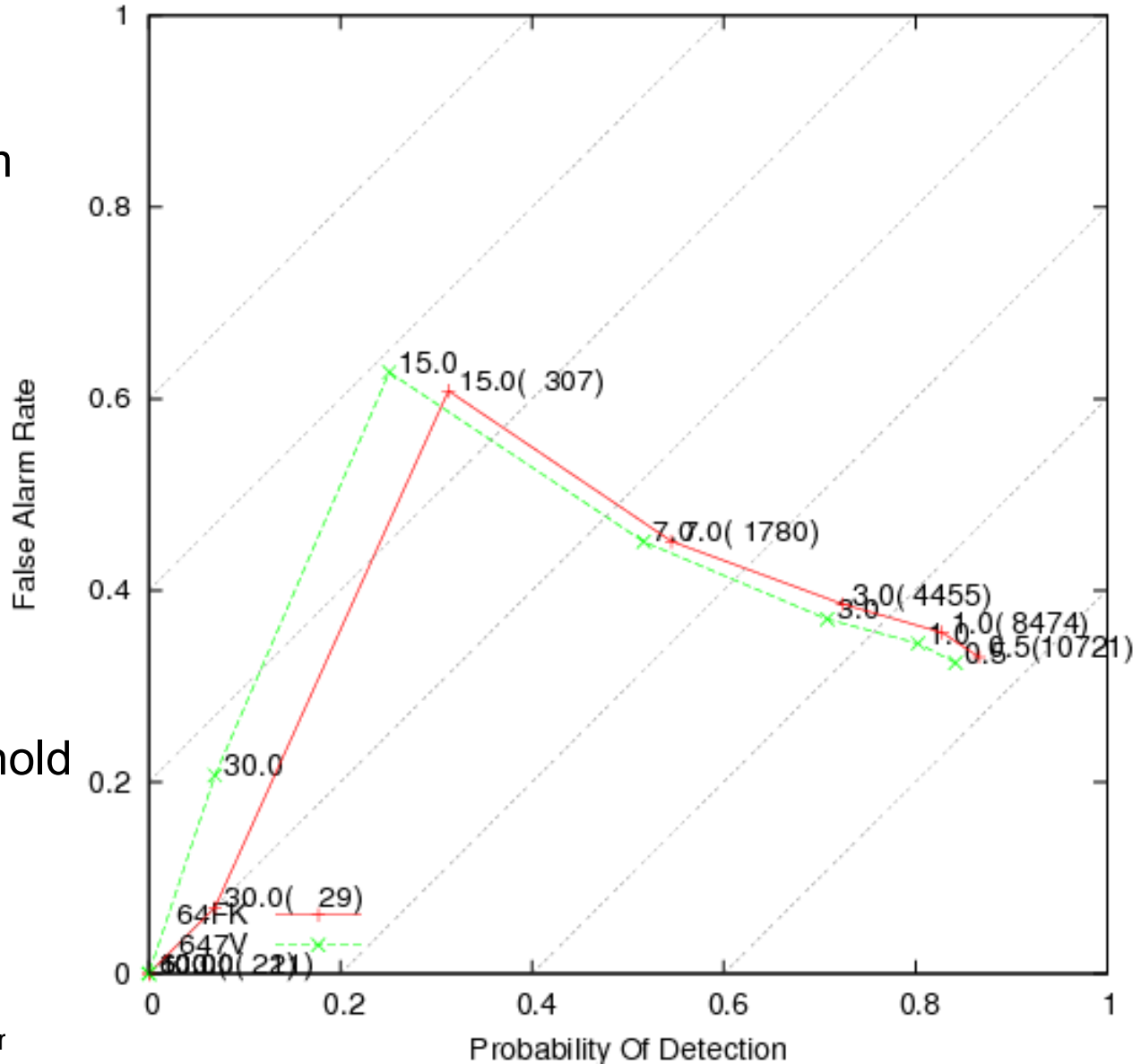
	Background RAIN	Background NO RAIN
Radar Obs. RAIN	Assimilation	Assimilation
Radar Obs. NO RAIN	Assimilation	No Assimilation

- Their impact on wind forecast is of the same order as the impact of IASI

→ redundant impact of radar reflectivities and of IASI data assimilation, on wind forecast, both @ 125km and @ 80 km
not additive impact ?

3.4 Impact on rainfall forecasts on top of radar reflectivities assimilation

- FAR vs. POD
  green = IASI @ 125 km
  red = IASI @ 80 km
  stats over 3 weeks
  in December 2009
  w/t rain gauges
- POD is better
  @ 80 km
- FAR is not modified,
  except for 15mm threshold



Conclusion

- Fairly good impact of IASI on top of first operational version of AROME
- Increasing IASI density up to 1 profile per 80-km box is encouraging:
  - Analysis increments have smaller scale as density is increasing
  - Bias correction (not shown) and cloud detection are still adequate
- Impact on forecasts is mainly neutral on top of radar reflectivities, but some improvements can be noticed (on rainfall forecasts, e.g.)
- As in global models, more data could be used / data could be better assimilated
  - Surface properties (including surface temparture)
  - Assimilation of cloud-affected radiances
  - etc.