A DIRECT LINK BETWEEN FEATURE TRACKING AND HEIGHT ASSIGNMENT OF OPERATIONAL ATMOSPHERIC MOTION VECTORS

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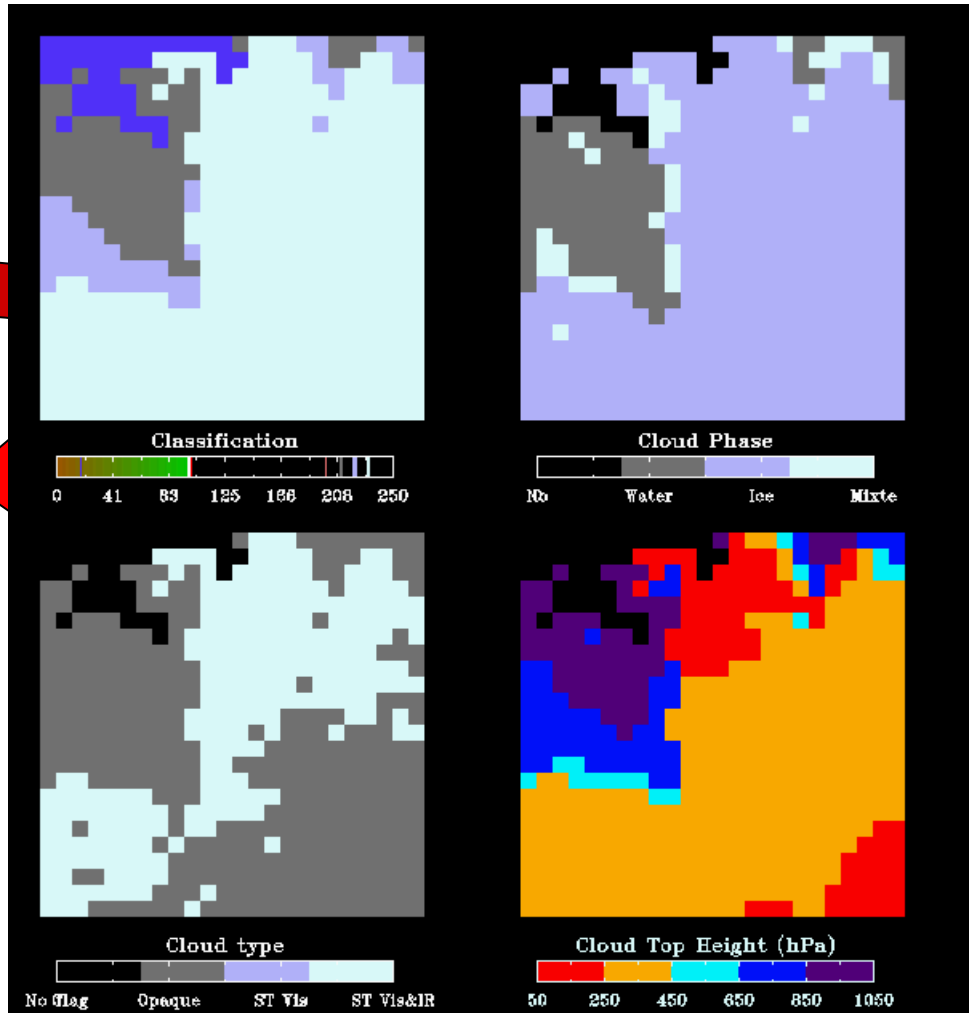
AMV algorithms

- Tracking features
- Height assignment
- Quality control

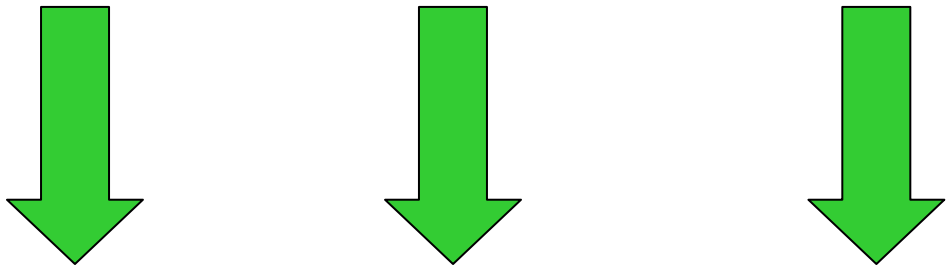


Current status of pixels selection for HA

- EUMETSAT: recent change
  - Former scheme: Cloud phase + CLA_CTH (5 layers)
  - New scheme: Coldest peak of CLA-CTH (ST corrected)
- NESDIS / CIMSS: 25% Coldest pixels
- JMA: recent change
  - Former scheme: 1% coldest pixels
  - New scheme: most frequent peak of CTH
- KMA: 15% coldest pixels
- …

So, the main rule is: There is no general rule…

Then…



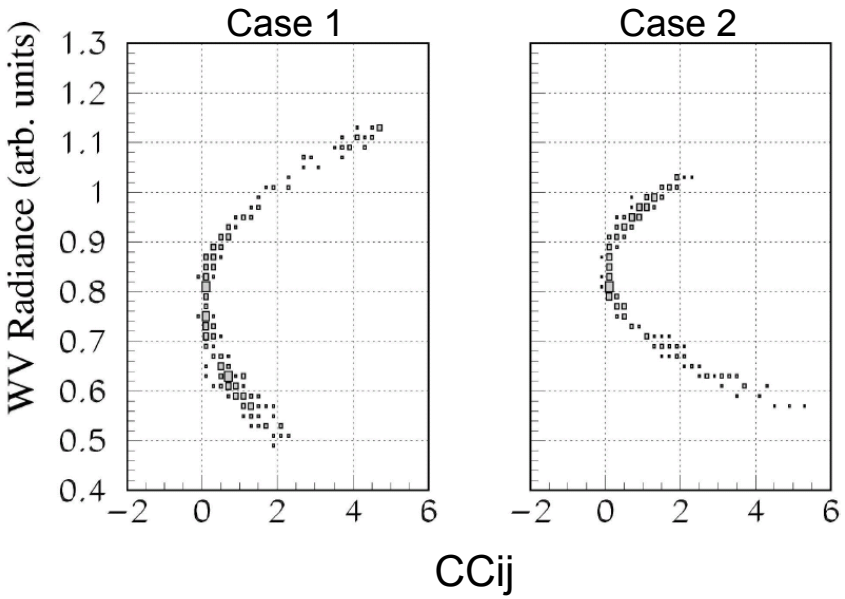
Is it possible to build a simple and clear rule of pixels selection to keep a close link between the feature tracked and the HA estimation ?

Büche et al. (2006)

Cross Correlation method

$$cc(m,n) = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\frac{a_{i+m,j+n} - \bar{a}(m,n)}{\sigma_a(m,n)}\frac{b_{ij} - \bar{b}}{\sigma_b}$$

$$\equiv \sum_{i,j}^{M,N} cc_{ij}(m,n), \qquad \textbf{Eq.(1)}$$



a : count of target image

b: count of search area image

$\bar{a}$: average of a

b : average of b

σ_a : standard deviation of a

σ_b: standard deviation of b

CC (m,n): Cross correlation coefficient

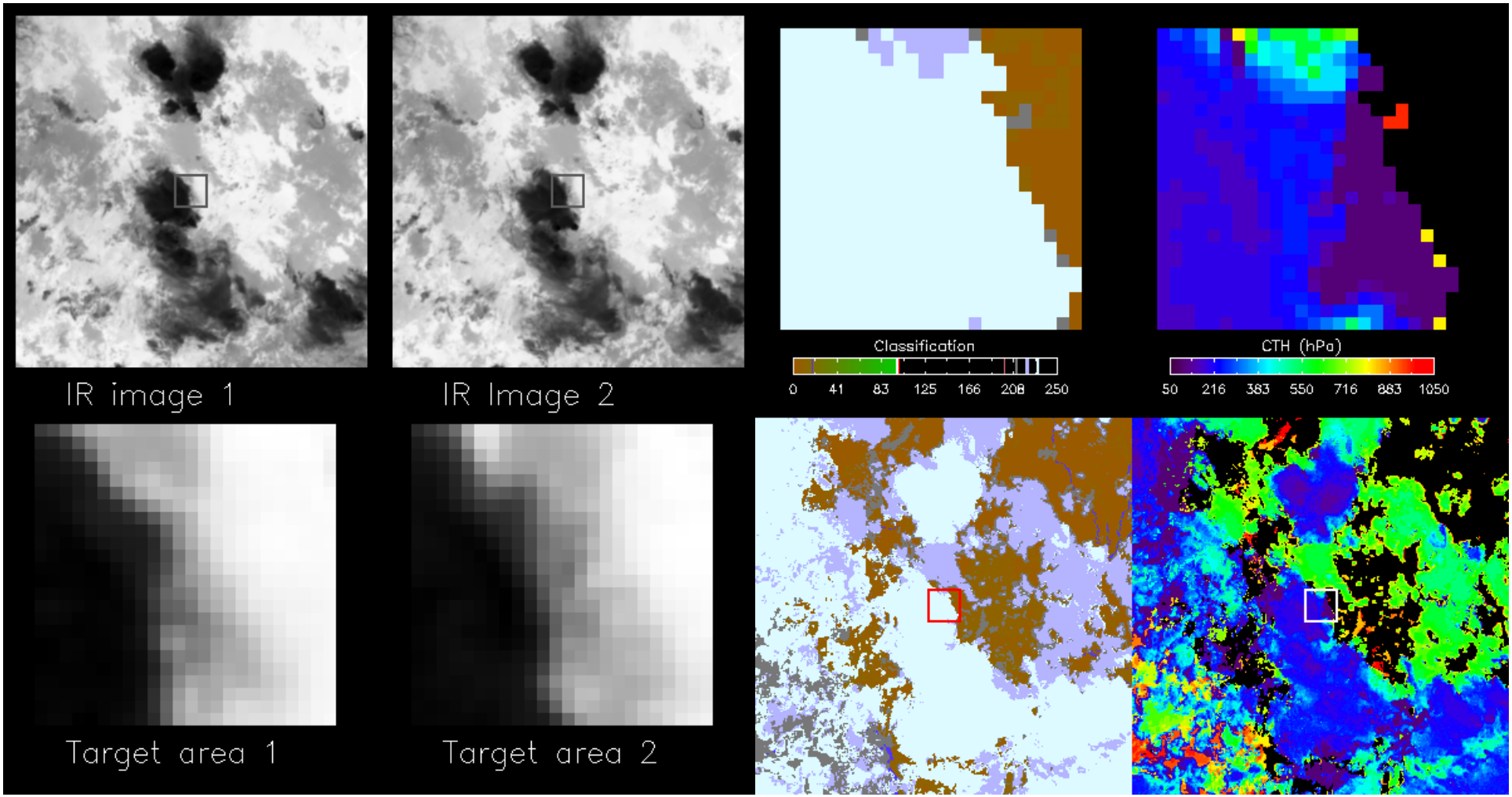
m, n: coordinate in matching surface

CCij: respective contribution of CC(m,n)

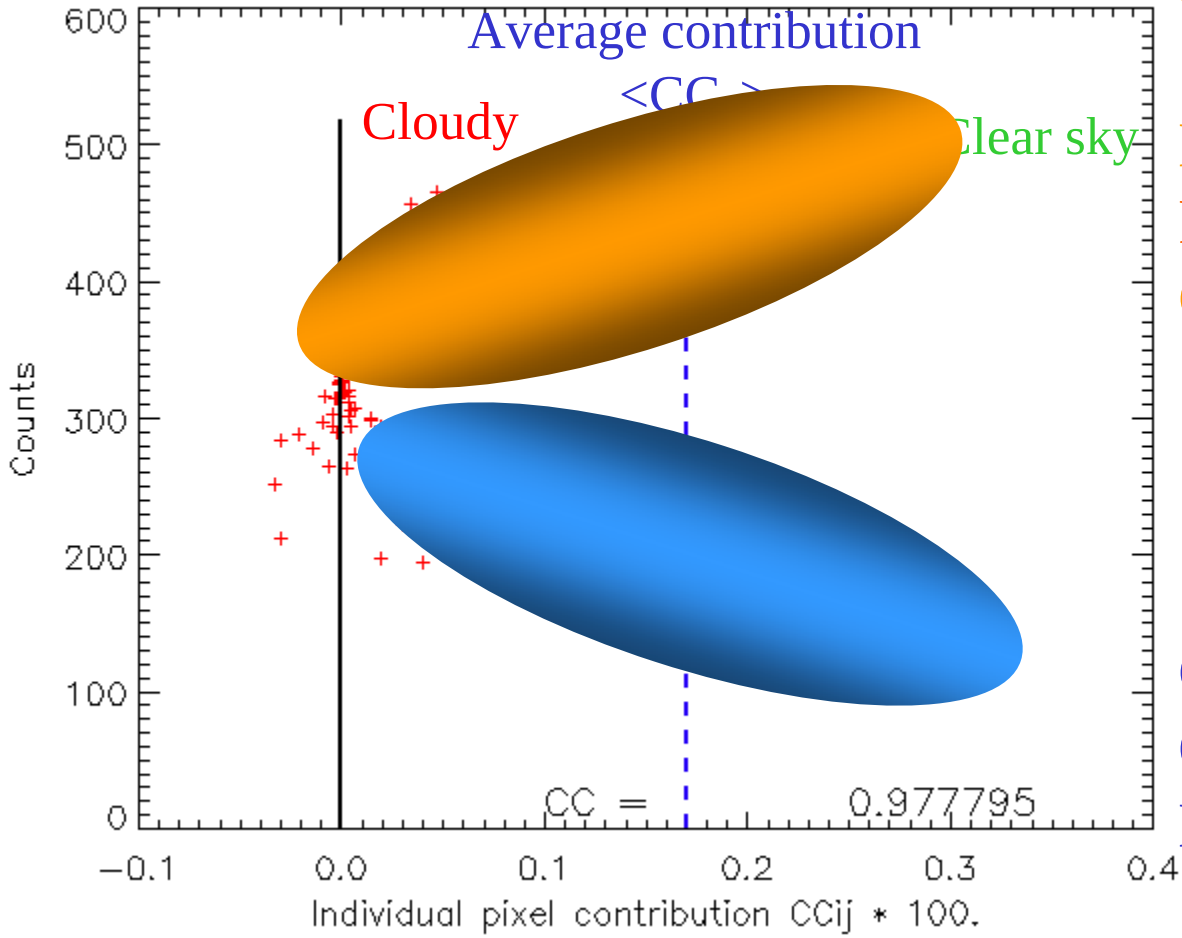
M, N : image size of target image (**=24x24 in EUMETSAT, 32x32 in JMA**)

The examples of 2-dimensional distribution of CCij and WV count by METEOSAT (from Büche et al.(2006)).

Case study


IR image 1
IR Image 2
Classification
0 41 83 125 166 208 250
CTH (hPa)
50 216 383 550 716 883 1050
Target area 1
Target area 2

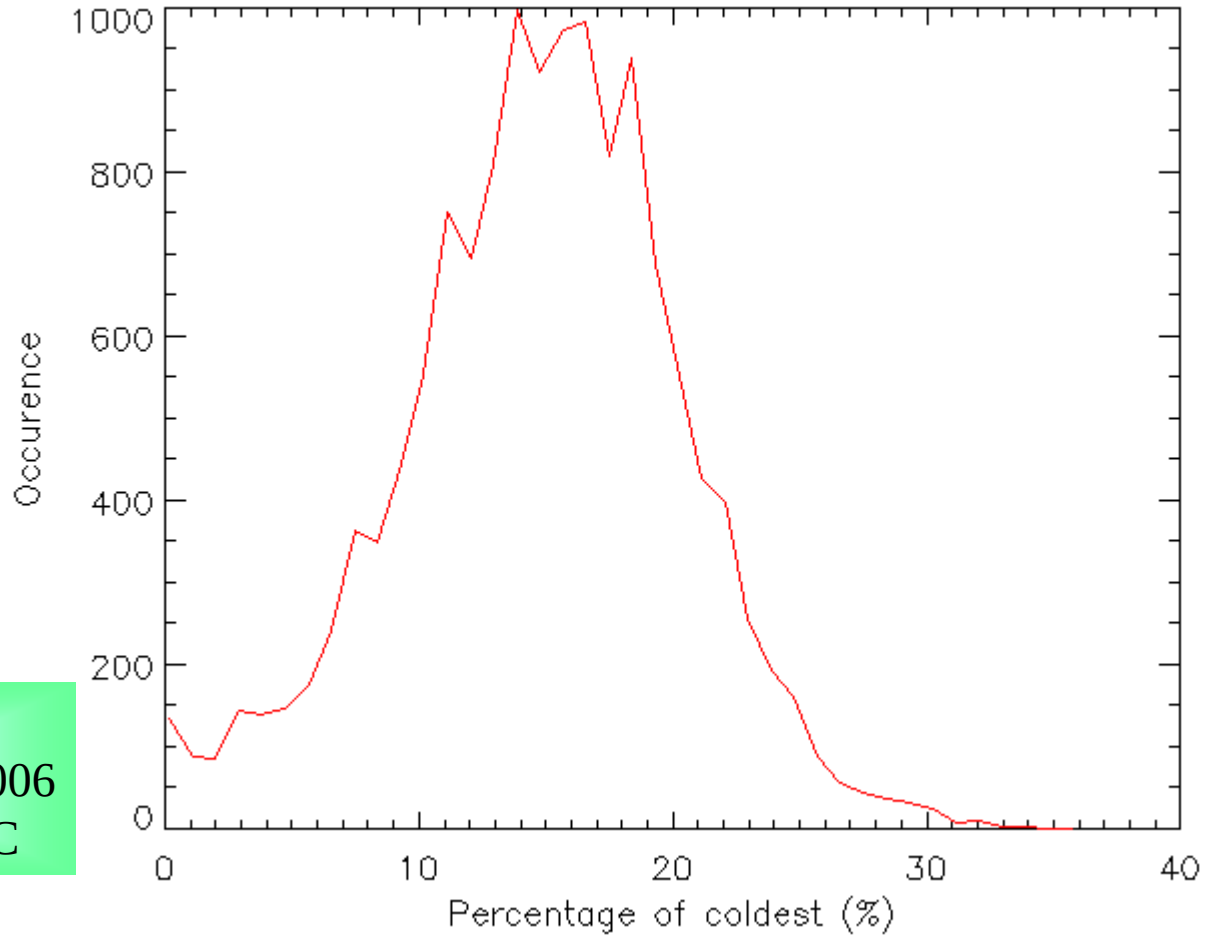
Description of CCij graphs



Clear sky
ST clouds
Low level
Fractional
Cloud edges
…

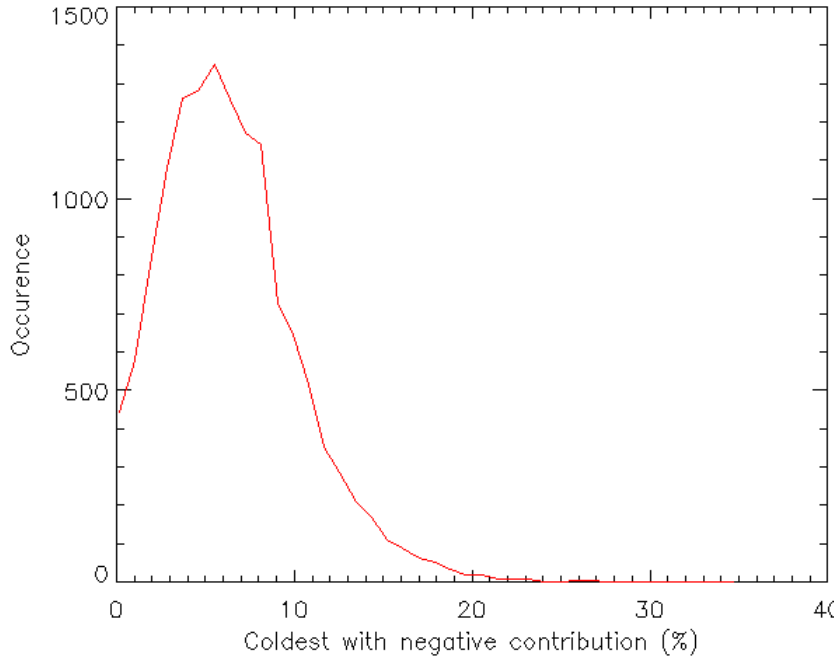
Cloud tops
Opaque
Highest

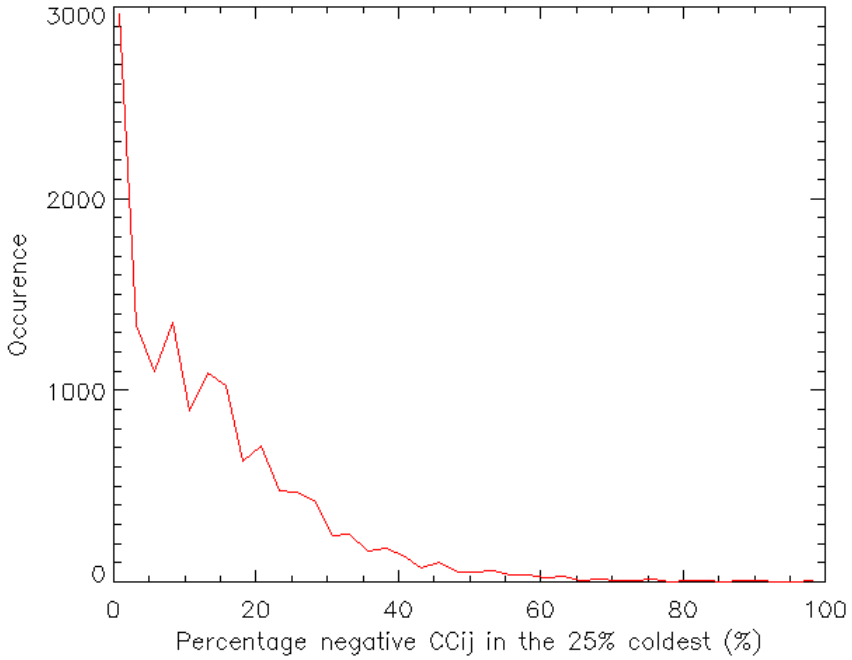
How many coldest pixels really contribute to correlation process



13995 AMVs
1st December 2006
2:00 – 2:15 UTC

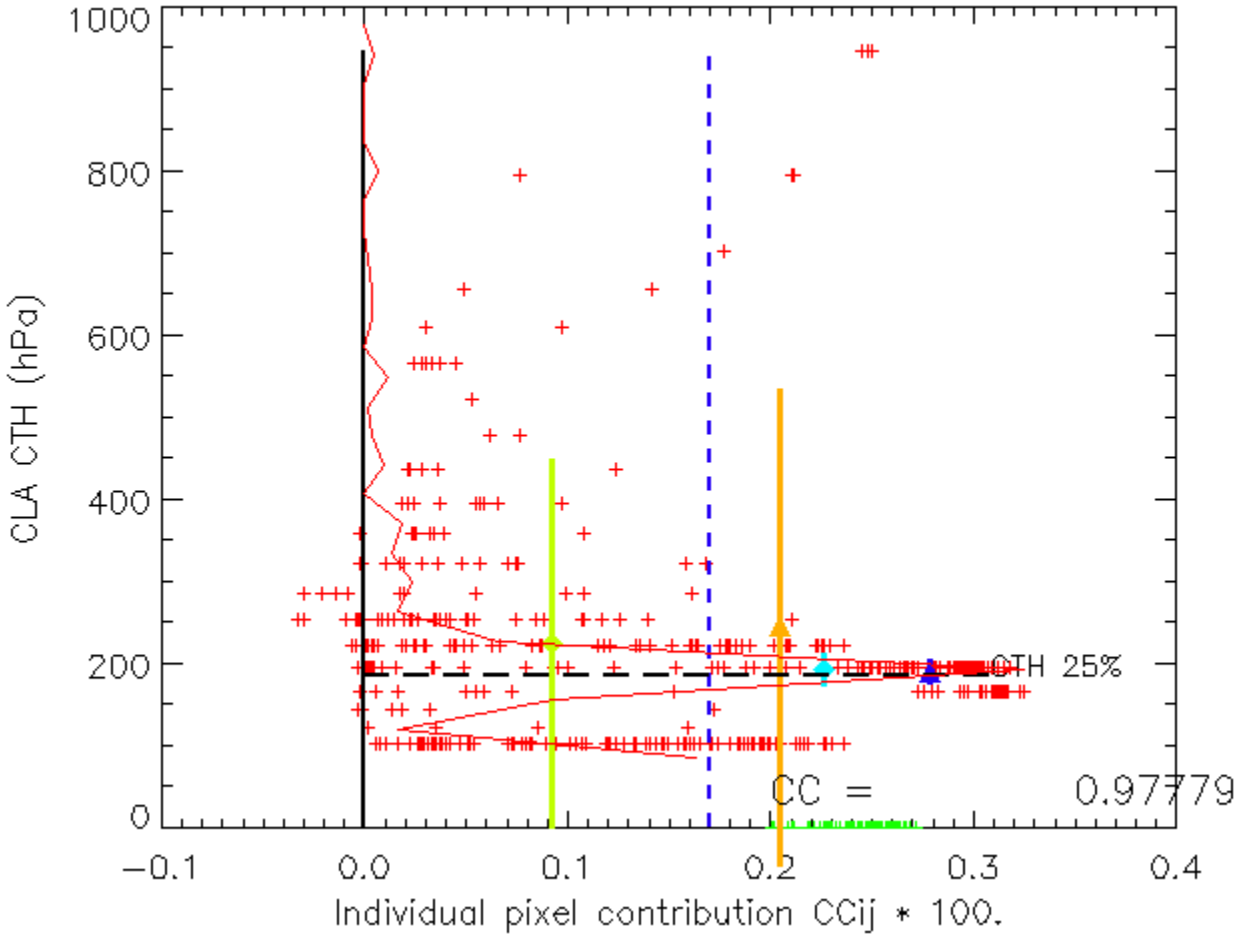
Negative contribution of coldest pixels



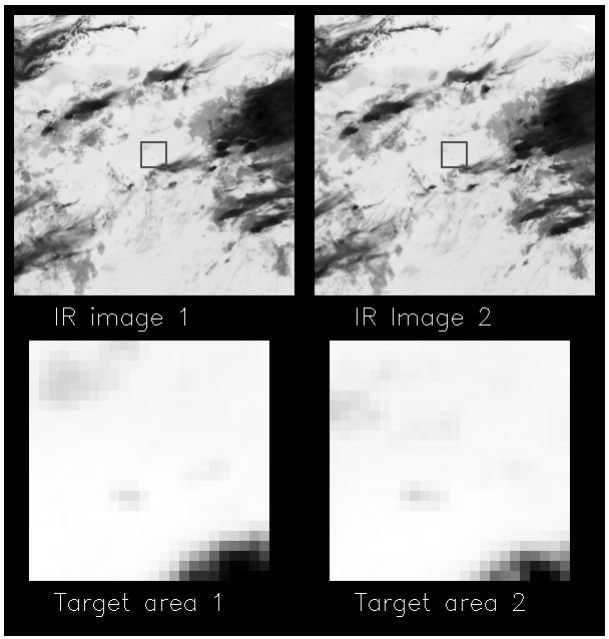


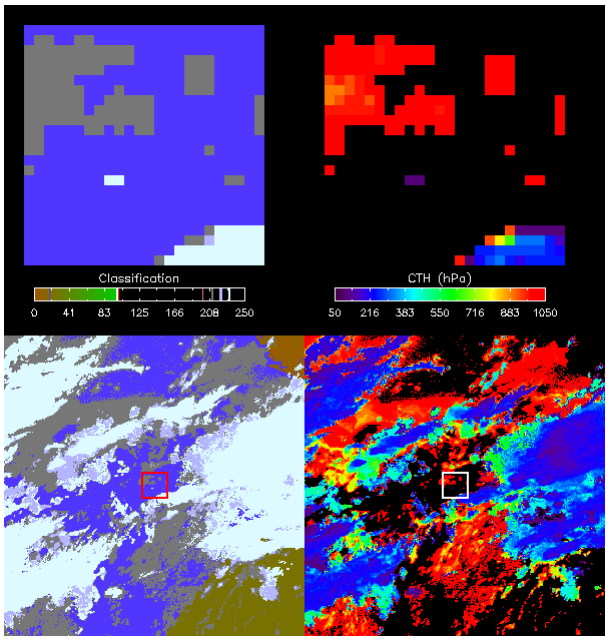
13995 AMVs ;1st December 2006 ; 2:00 – 2:15 UTC

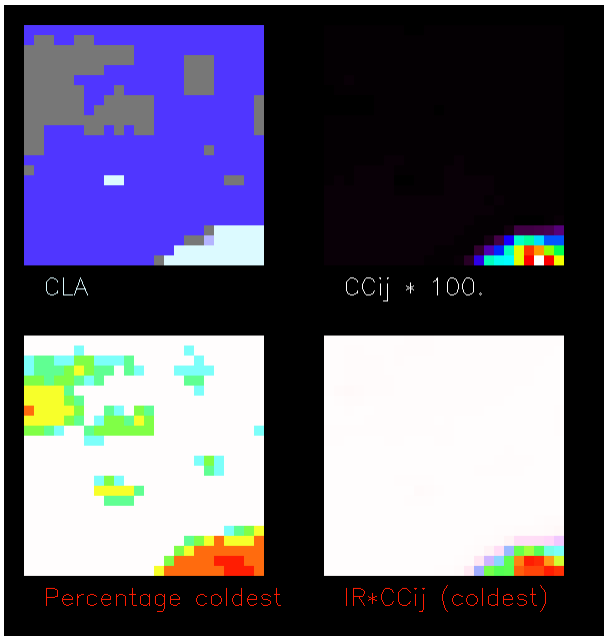
Calculation of CCij weighted pressure and STD from CLA-CTH

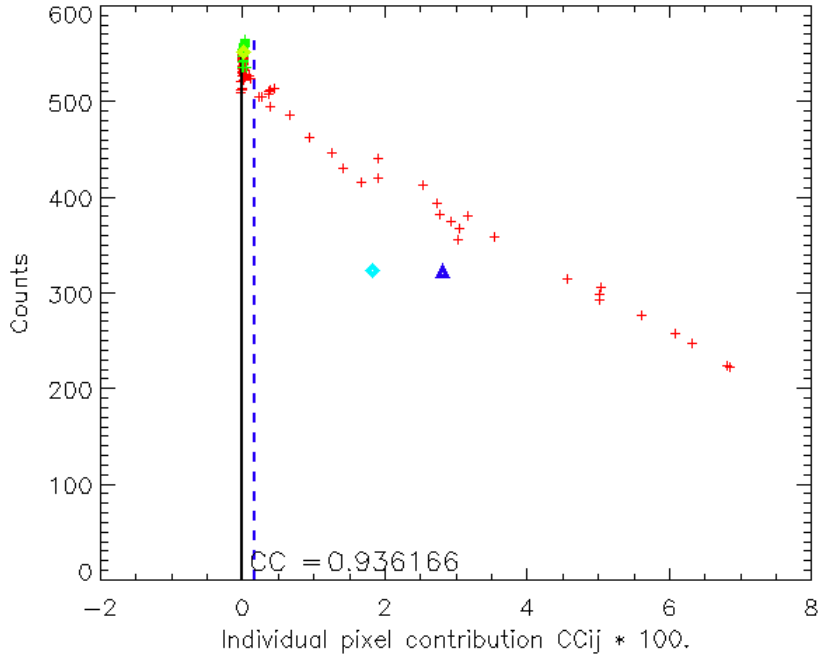


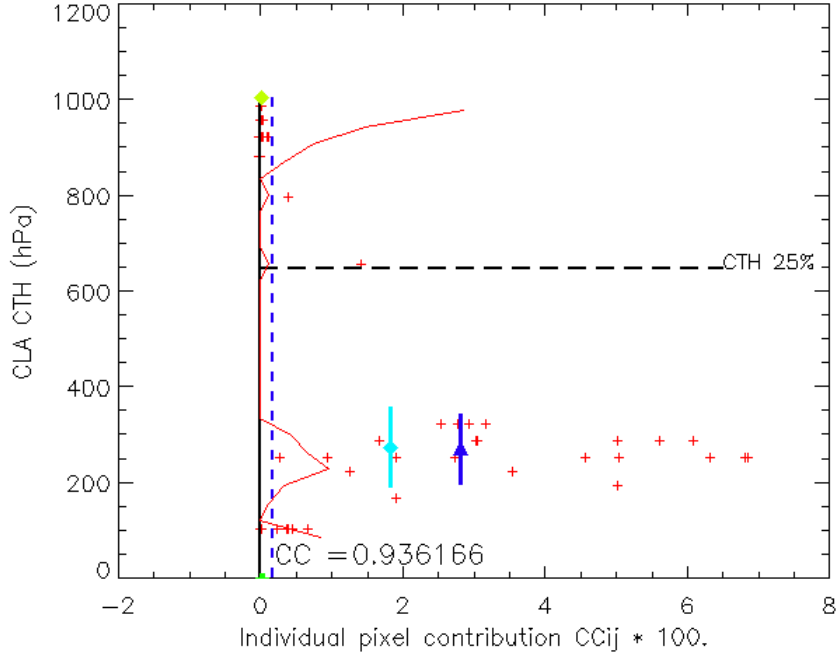
Few coldest pixels contribute



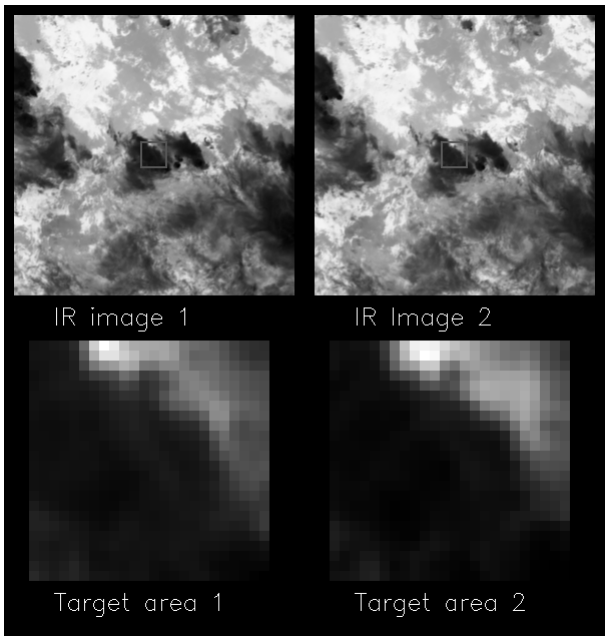


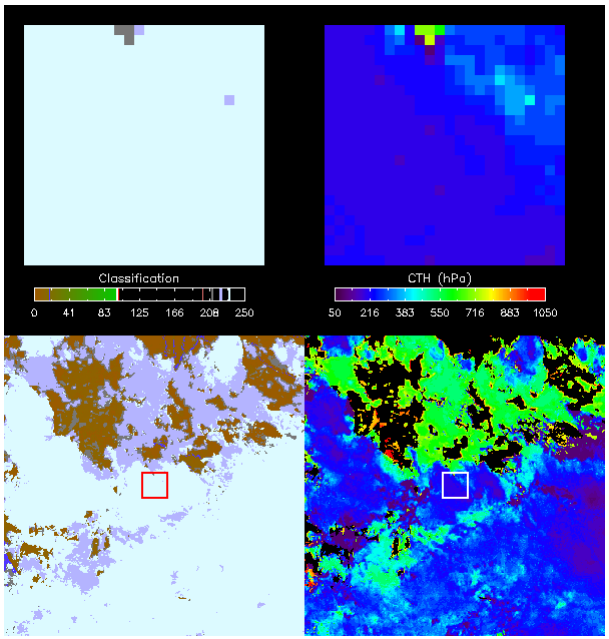


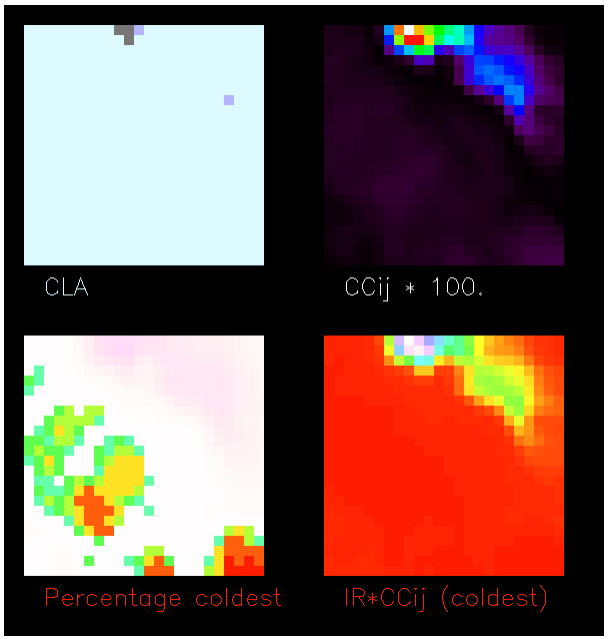


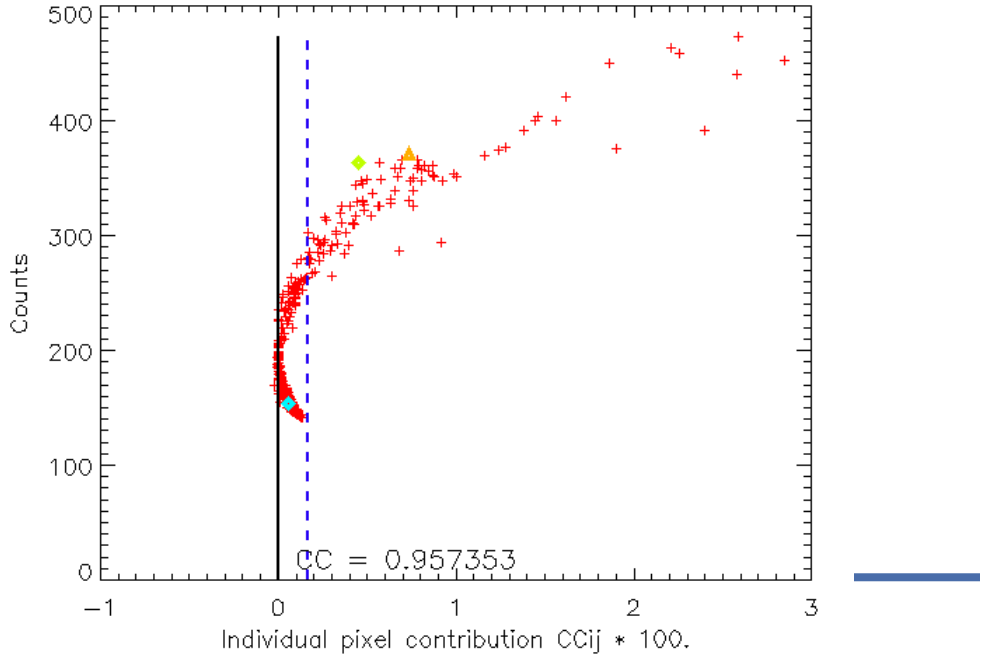


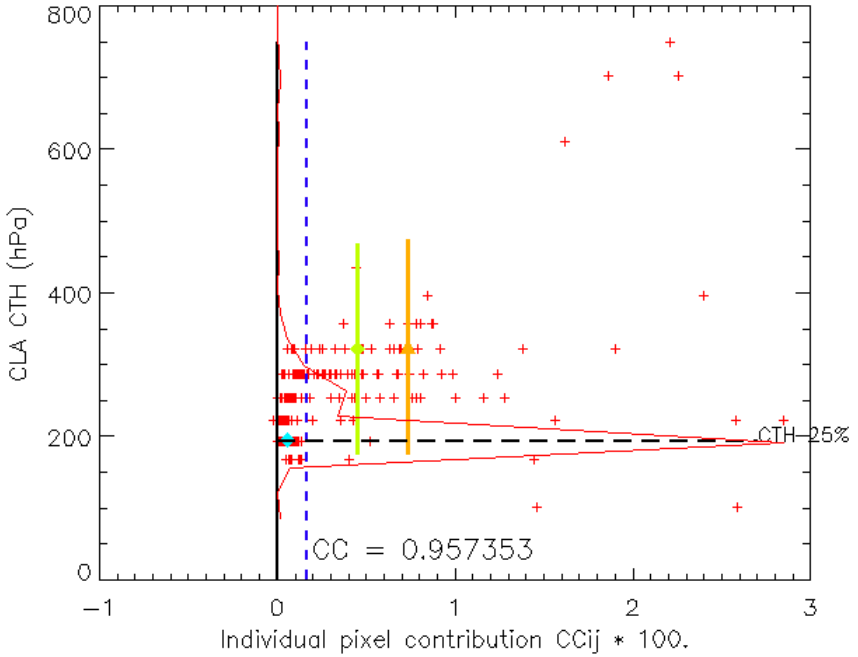
Warmest branch contribute the most



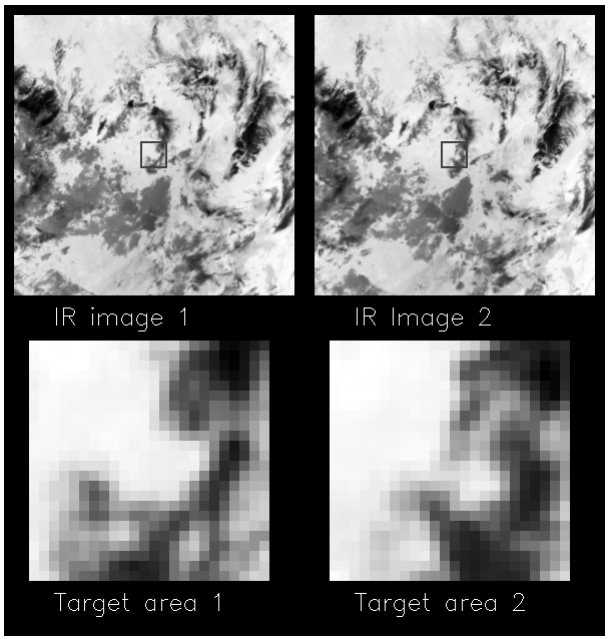


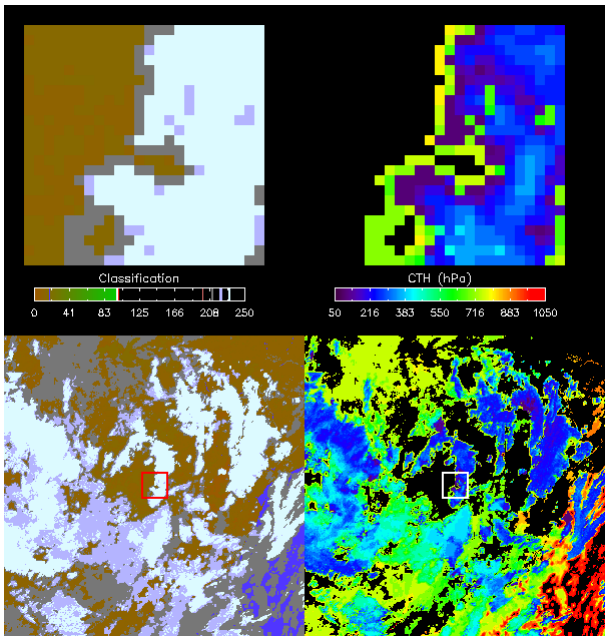


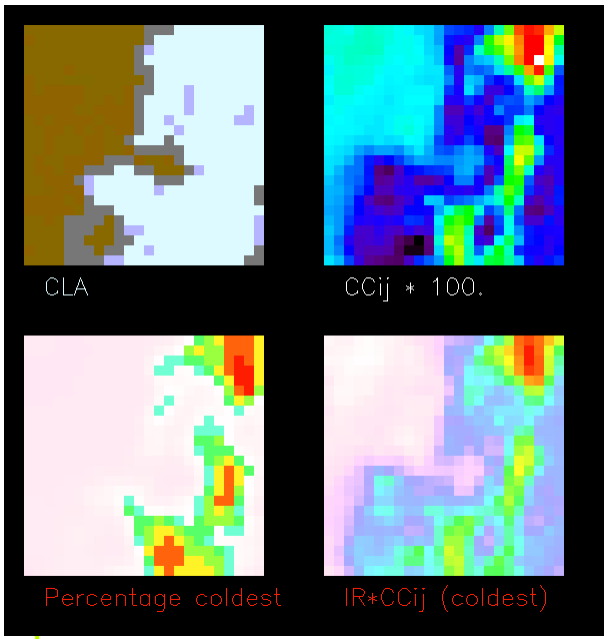


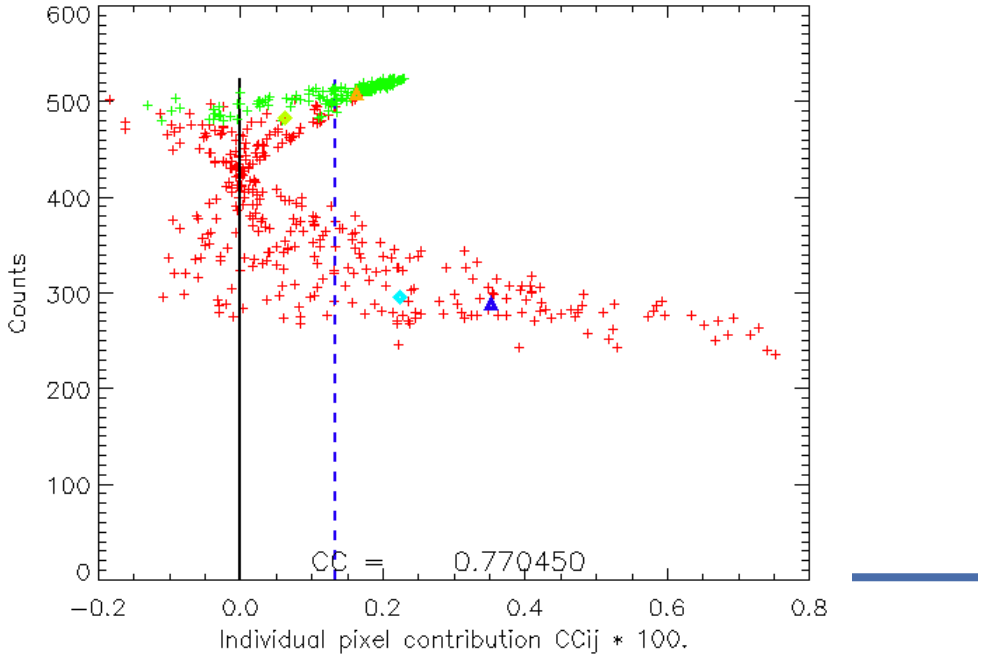


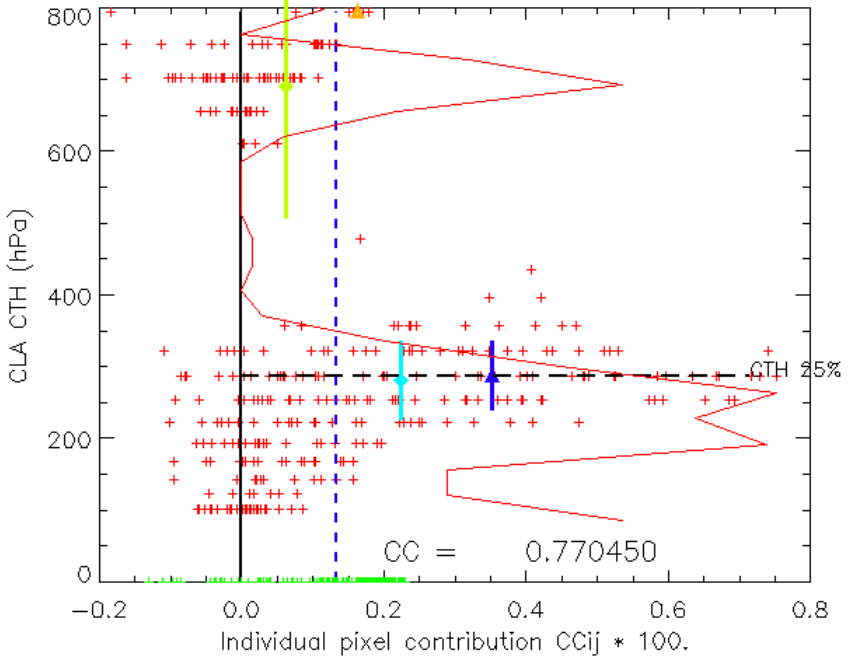
Negative contribution to correlation



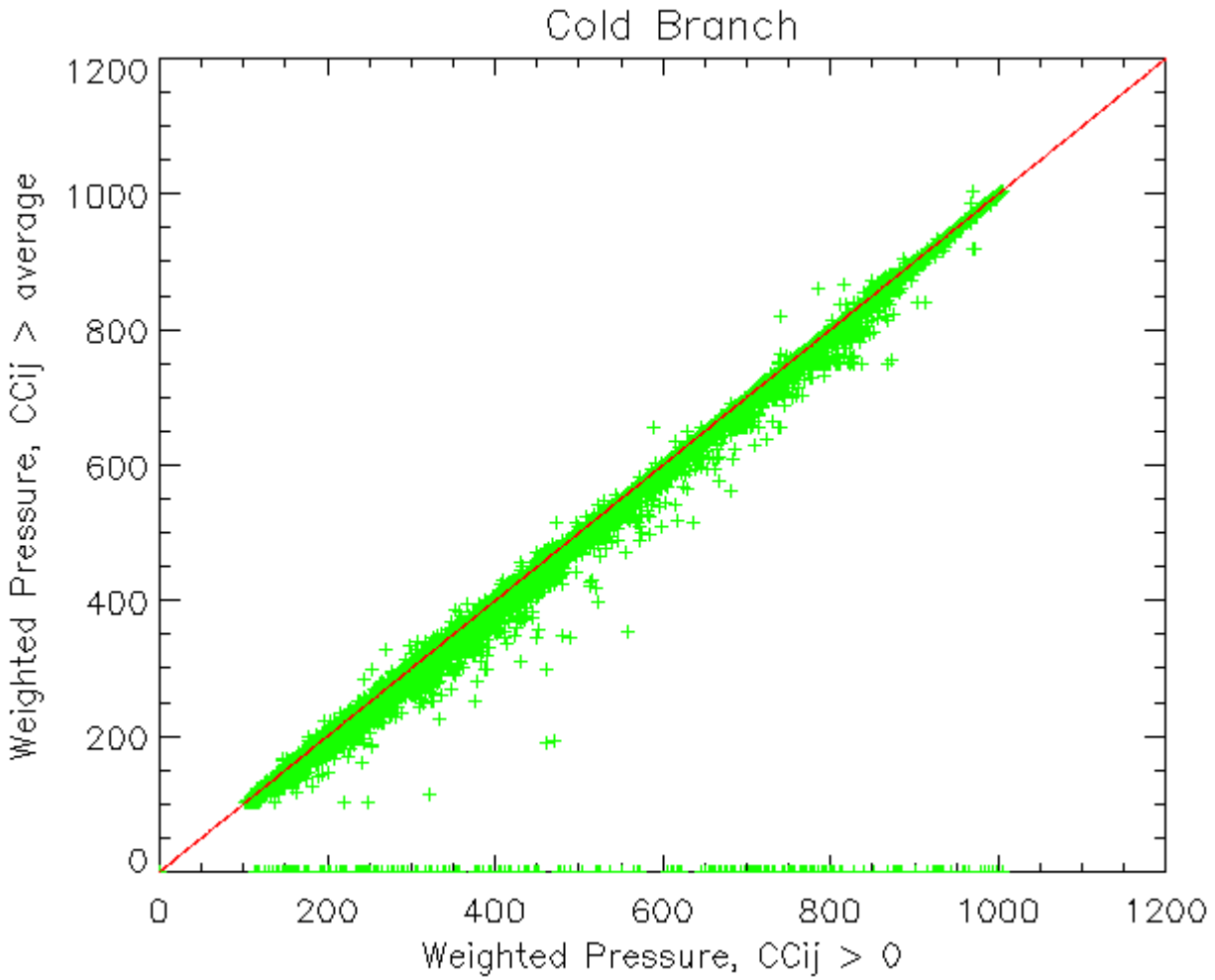




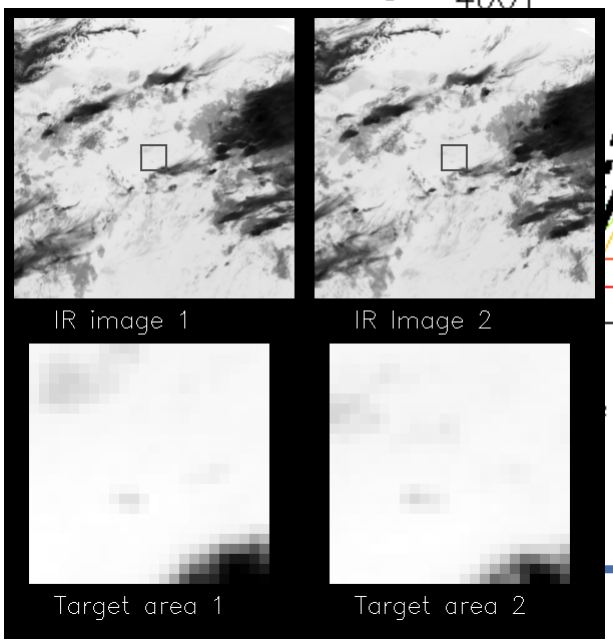


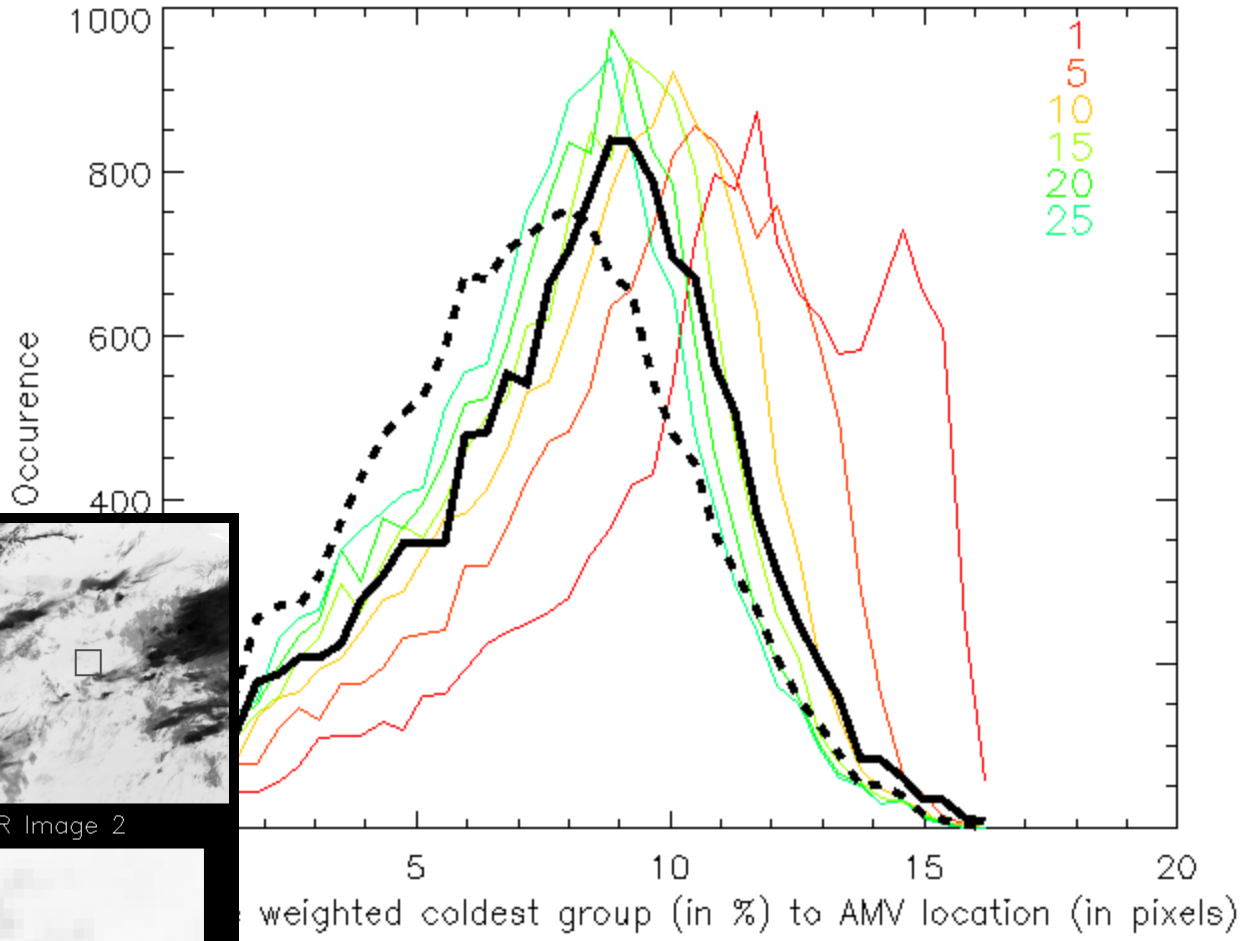


Cold branch pressures



Final AMV location





Conclusions on tracking

- Coldest and warmest pixels contribute the most to tracking process

- Coldest pixels can also have a negative contribution to CC, elimination of these ‘ghosts cloudy pixels’ for HA.

- Very heterogeneous types of situation → need a specific and dynamic treatment for HA

- Possibility to relocate geographically AMVs on tracked feature.

Conclusions on HA

- Fixed percentage of coldest pixels probably not adequate every time (selection of clouds at different levels).

- Histogram of CLA-CTH also not appropriate every time (select ST and opaque clouds together).

- Use of CCij allows a specific treatment for each AMV and associated errors of AMV pressure.

- Various possibilities to include CCij in HA are tested (See also Oyama et al. 2008).

- Establish the close link between HA and ‘detected motion’

Prospectives

- Test this technique on a long period in operational environment (Comparison Radiosonde, forecast, assimilation in NWP models…etc.)

- Use it with future OCA product at EUMETSAT (Watts et al., 1998).

Other critical issues for AMV

- Is CLA-CTH good quality ? (Seze et al., 2008)
- Sensitivity of HA techniques (Borde and Dubuisson, 2007)
- AMV as a layer ? (Velden and Bedka, 2008)
- Are the detected motions and speeds really representative of local winds ? (Von Bremen et al., 2008)
- …

Thanks