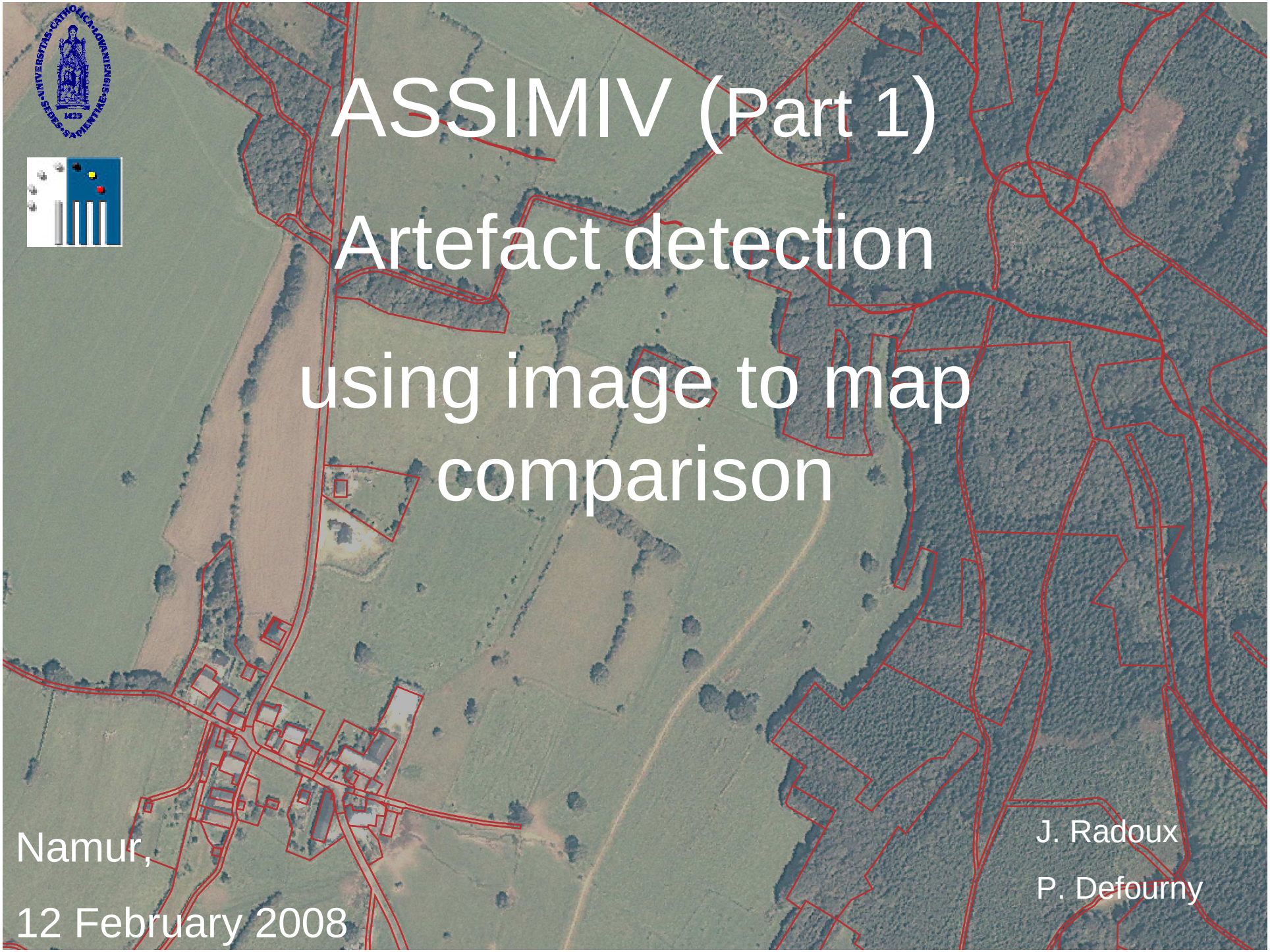


ASSIMIV (Part 1)

Artefact detection using image to map comparison

Namur,

12 February 2008

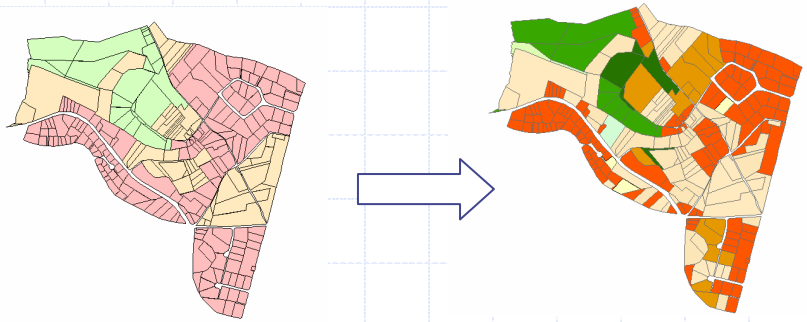
J. Radoux

P. Defourny

ASSIMilation of Image in Vector

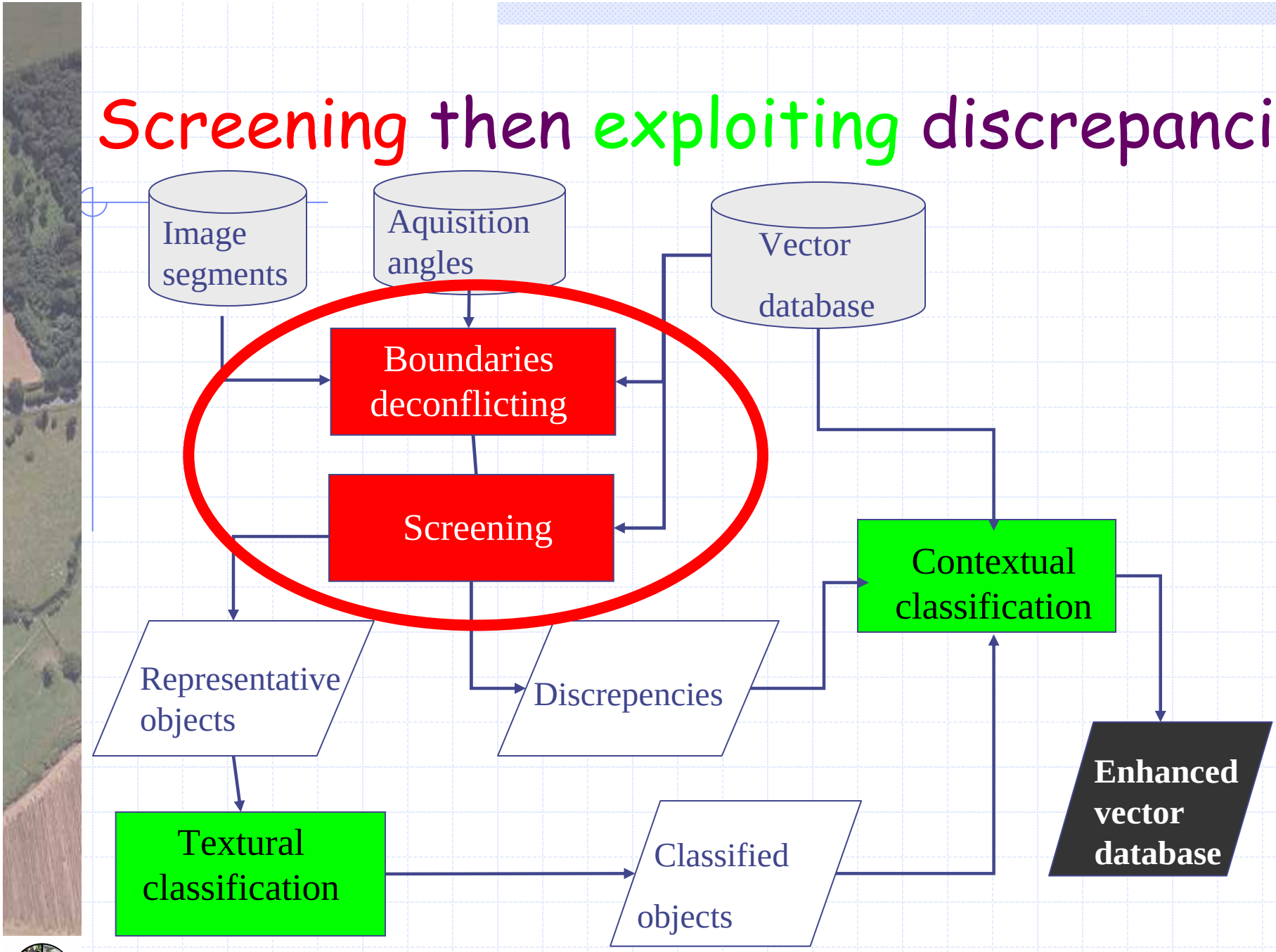
- Update

- Upgrade



For assimilation of VHR images into planimetrically accurate vector DB

Screening then exploiting discrepancies



3 types of discrepancies…

- Update & upgrade
  - Objects
- Artefacts
  - Objects
- Planimetric errors
  - Edges

First step : boundary artefacts

Consistent vector boundaries ?

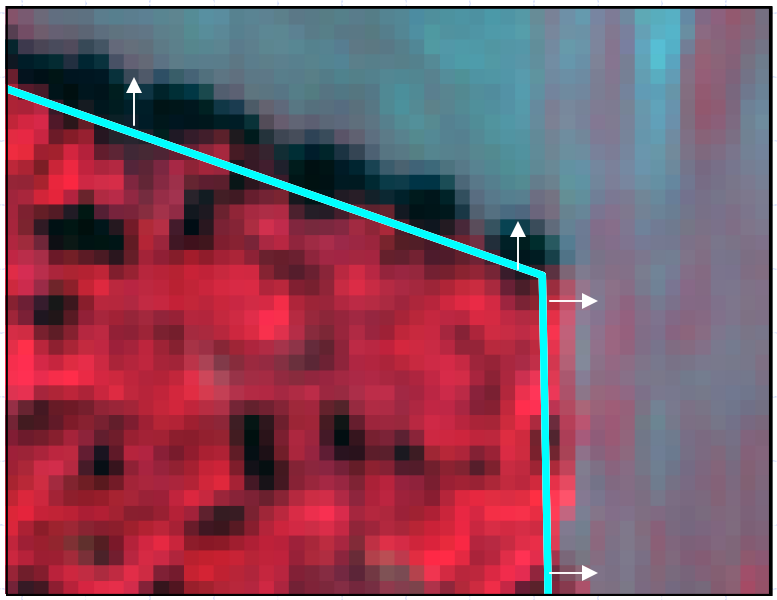
- Adjust GIS database to pseudo ortho-image
  - Trigonometric model
- Transfer GIS labels to image-objects
  - Zonal majority filter
- Measure planimetric errors along edges
  - Accuracy and precision
- Detect potential artefacts
  - Statistical approach

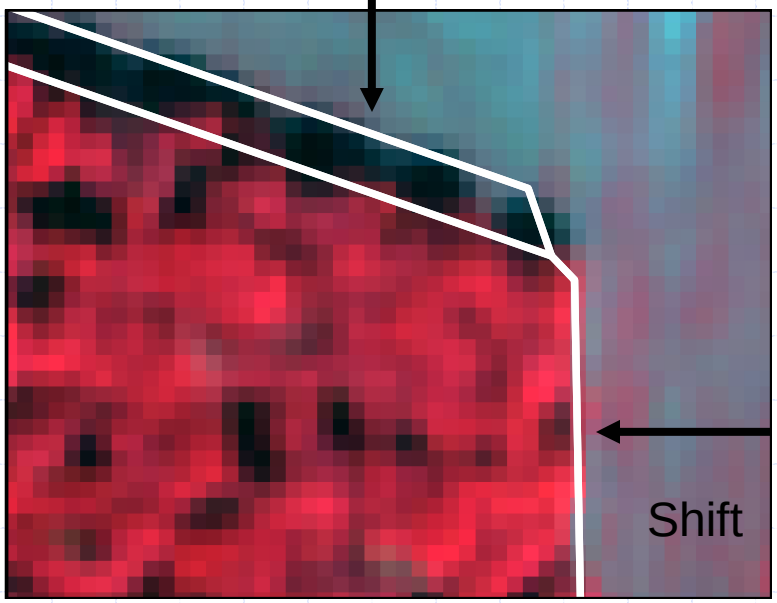
Trigonometric model

- Residual x-parallax shift
  - Proportional to object height
  - Function of the viewing zenith angle
  - In the direction of the viewing azimuth angle
  - Shift = H * tan(VZA)
- Apparent shift
  - Vertical sides can be similar to the object top
    - E.g. hedges, but rarely buildings
  - Vertical sides are part of the same object

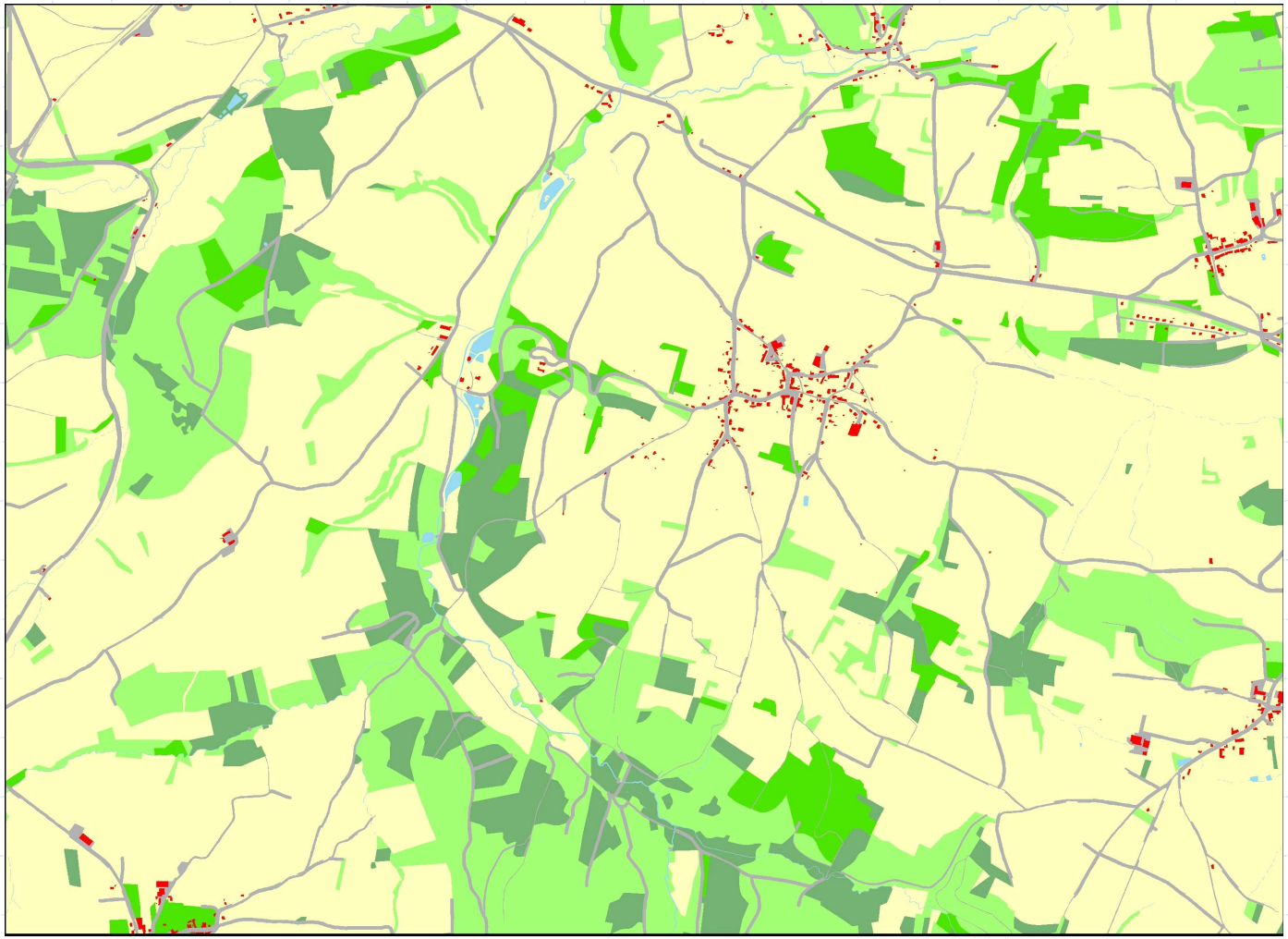
    →No apparent shift when facing the satellite

Automated edge adjustment and shadow candidate detection

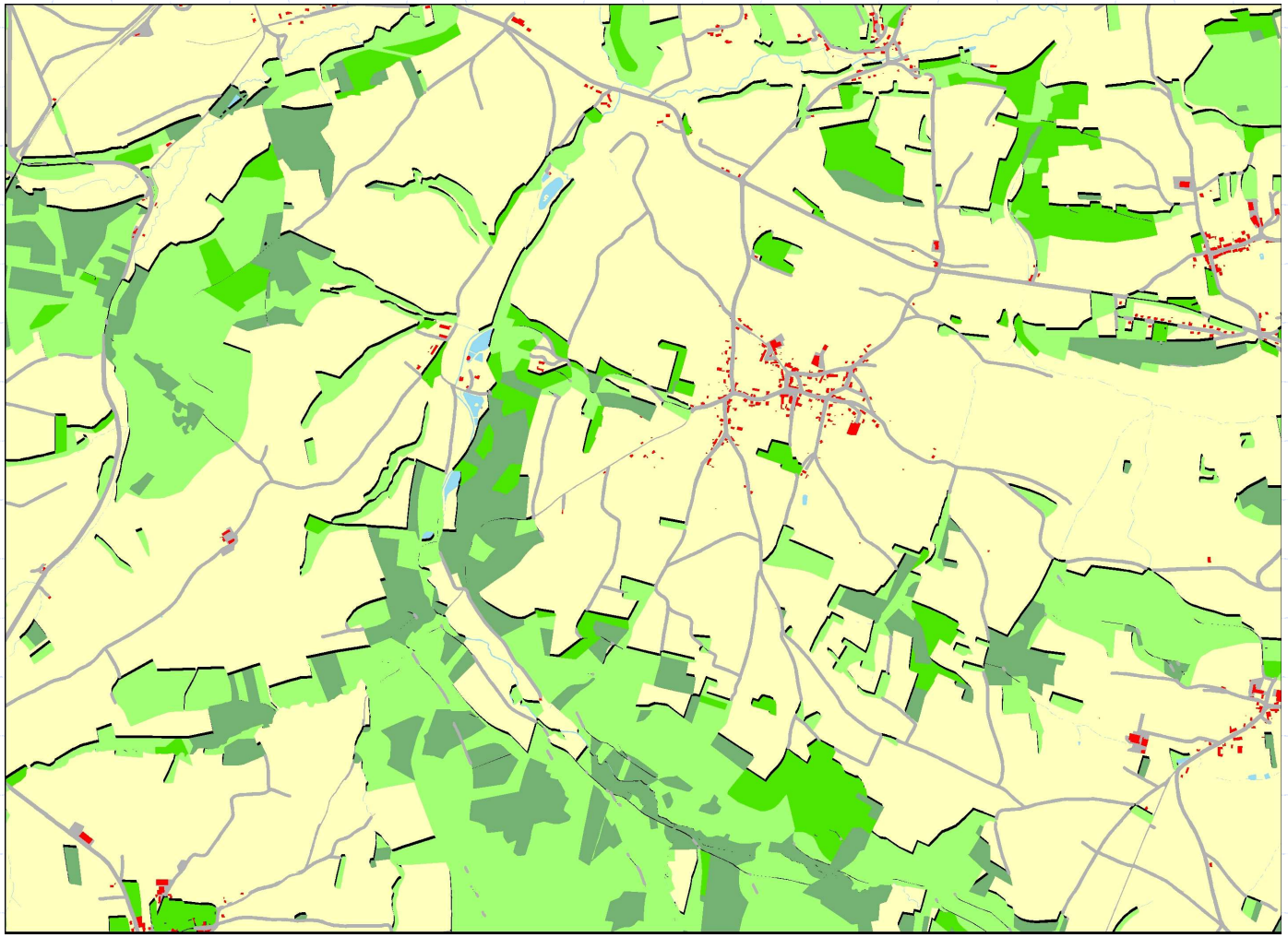




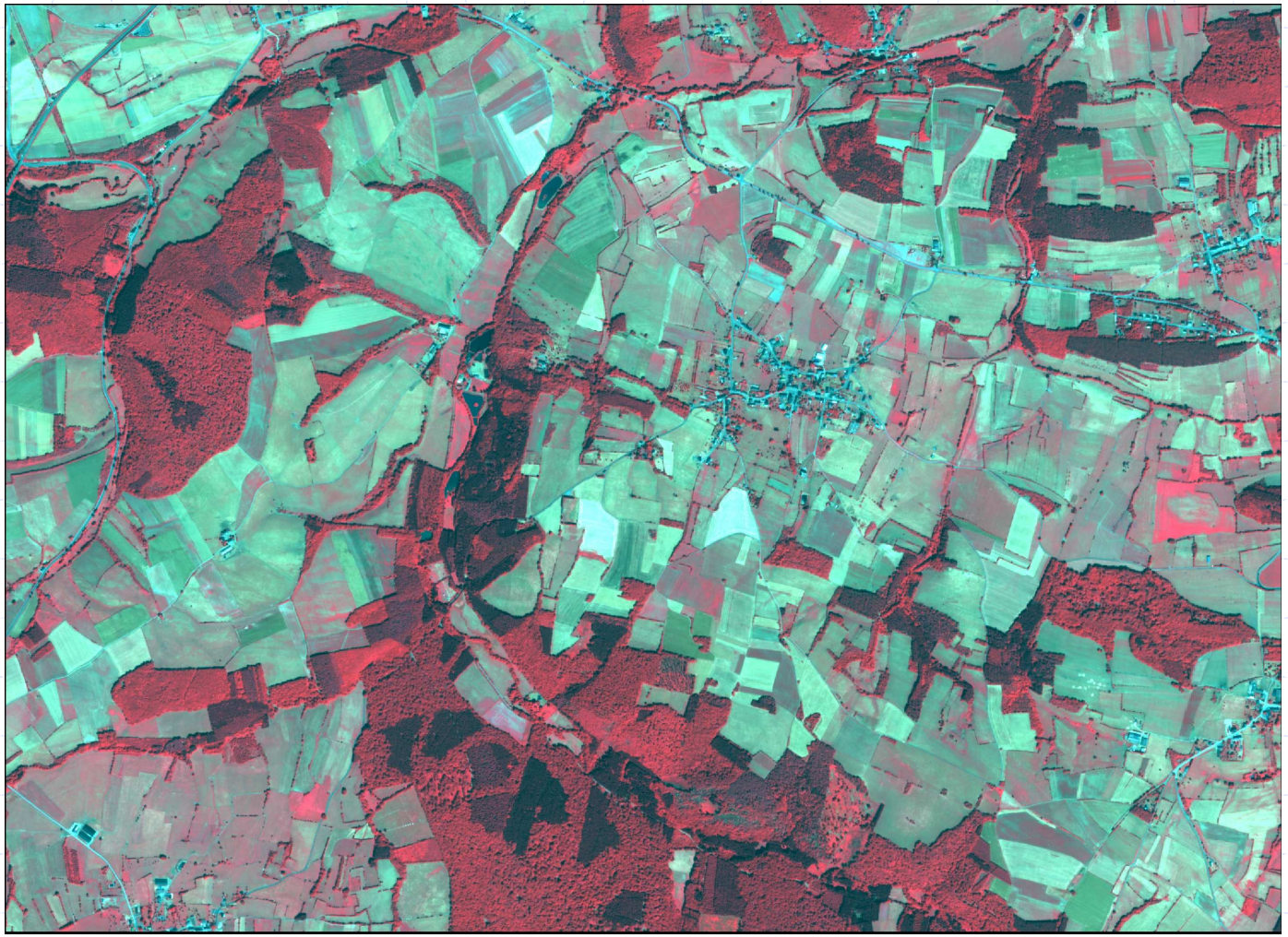
Original vector database



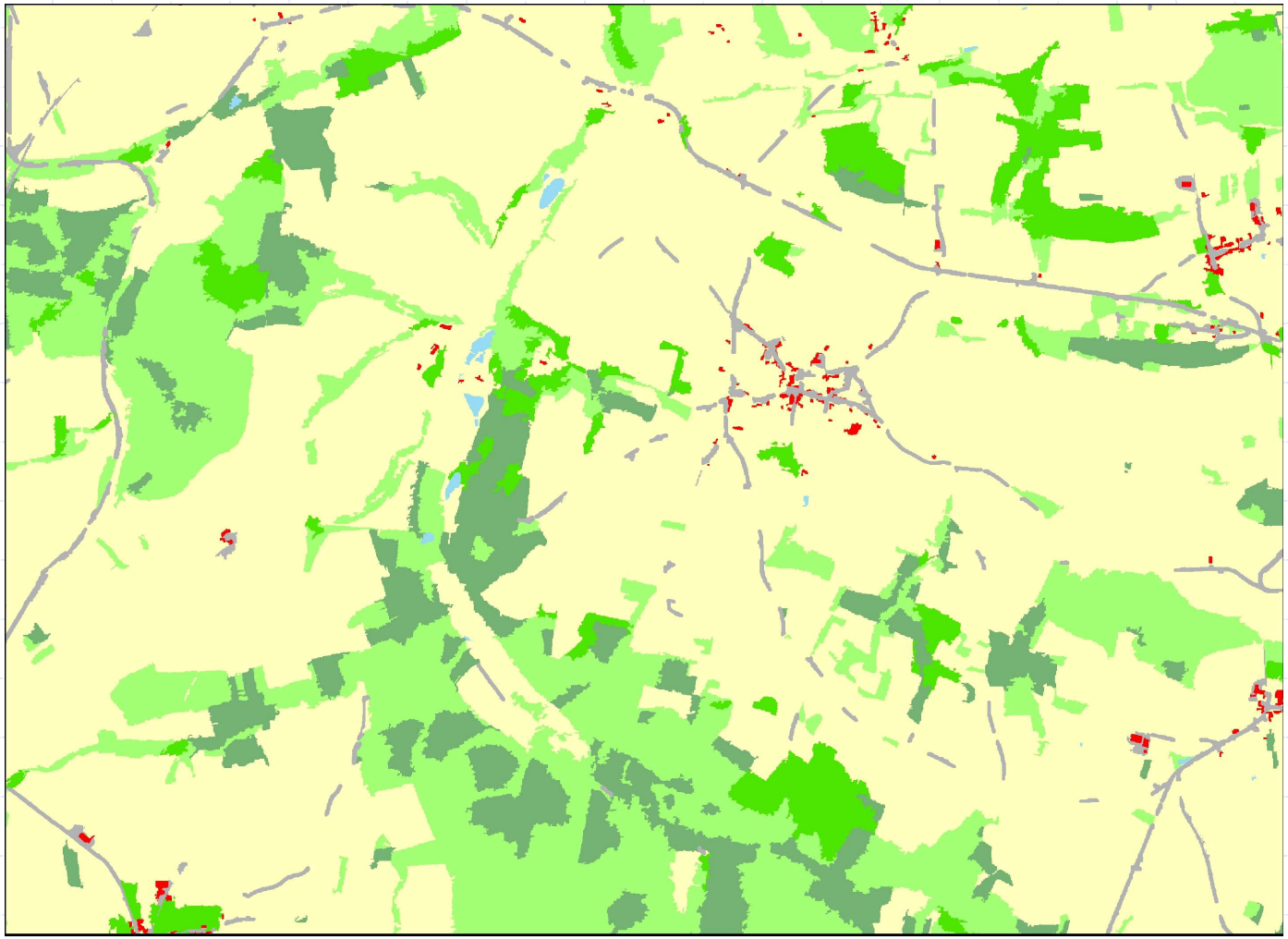
Shade and parallax added



Quickbird image → over-segmentation



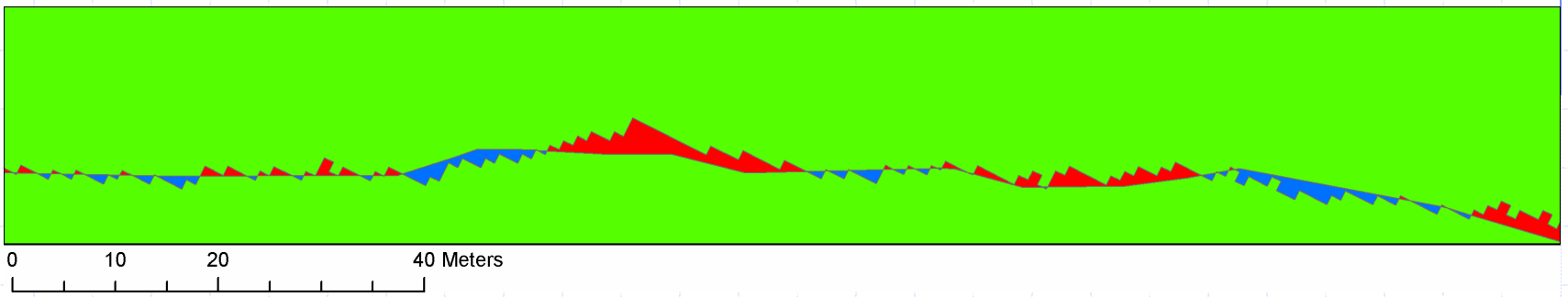
Automated majority-based labelling



Edge quality assessment

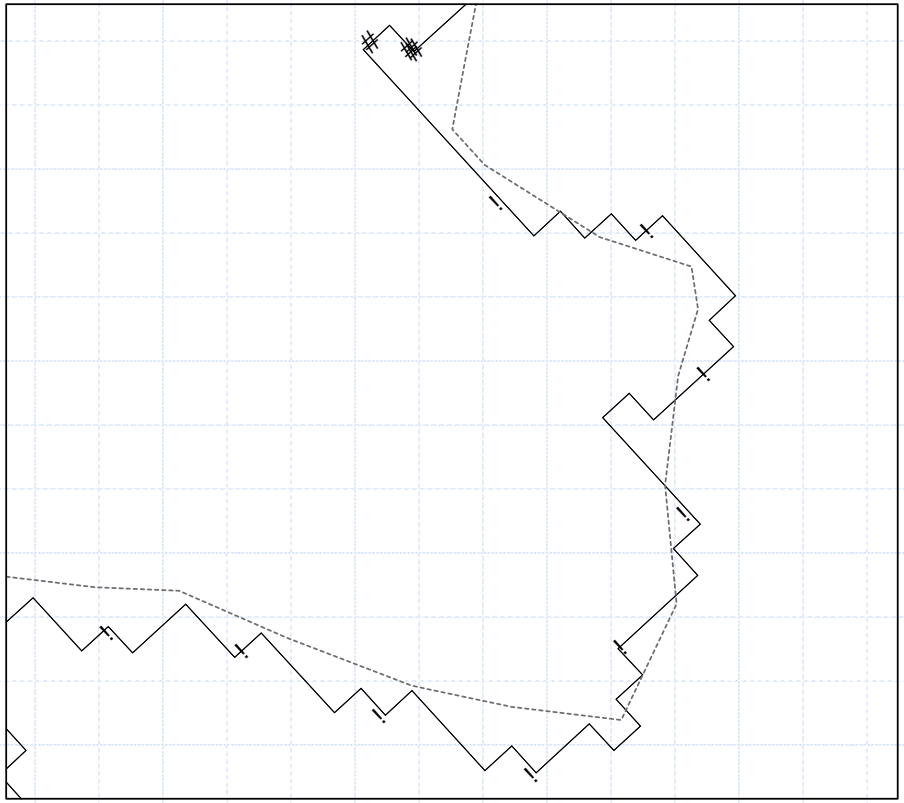
- Indicators for accuracy and precision
  - Edge based bias and standard deviation
- Parallax error
  - Rough height estimate (checked with shadows)
- Mislabelled polygons
  - Processed in object conflict detection (part 2)
- Other conflicts
  - Error above RMS and class uncertainty : update needed (GIS-based bias removal)
  - Errors below RMS or class uncertainty : tolerated

Normalised bias : systematic errors



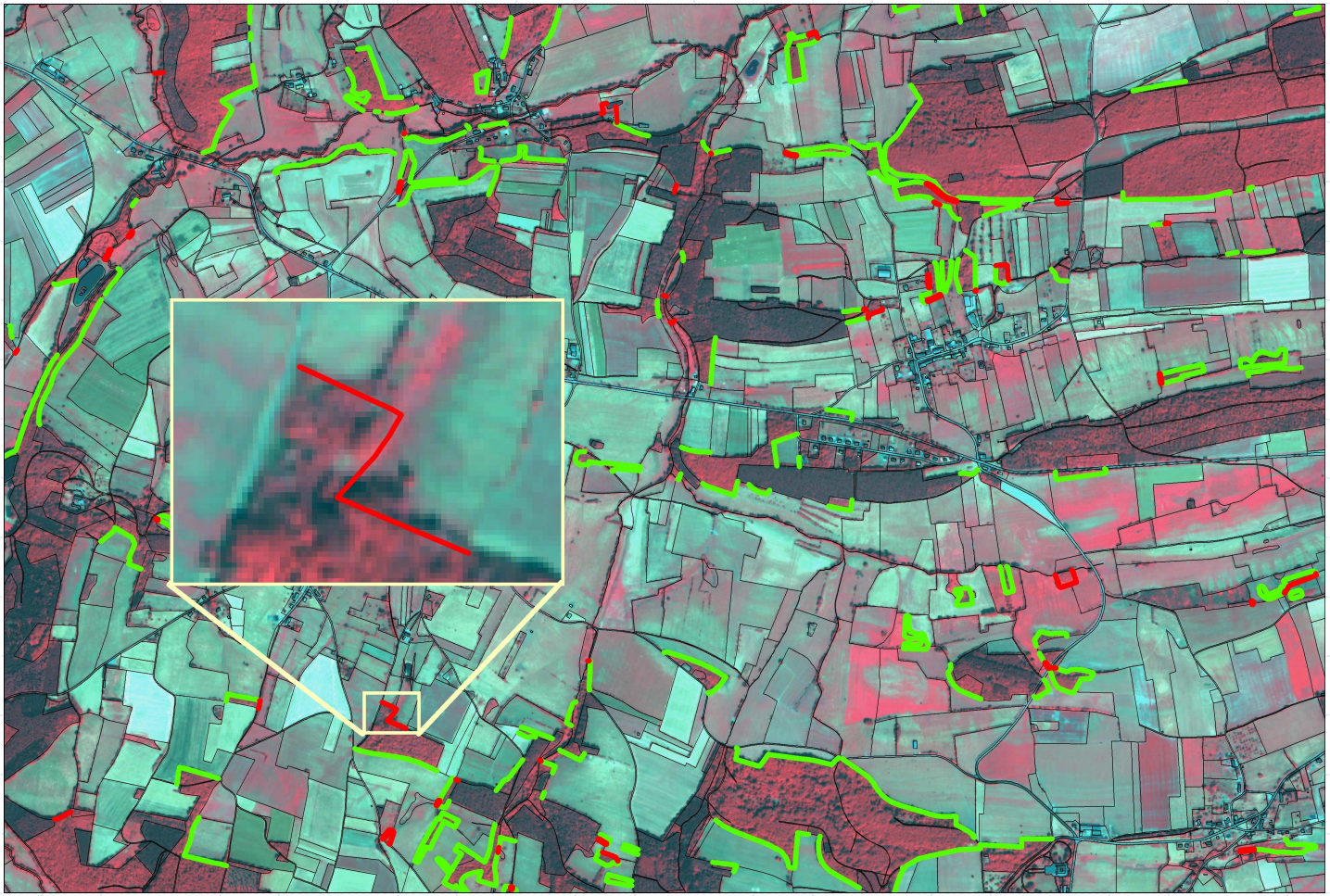
- Difference between invasion and recession
- Normalised by reference interface length
- Affected by
  - Edge definition (Database bias)
  - Image acquisition (Image bias)

Sampling for STD estimation



- Some edges are more reliable than others
  - Ecotones
  - Fuzzy edges
  - Simplified objects

E.g. : forest/crop fields boundaries



Second part : Object conflicts

Are « brother » sub-object similar ?

- Per field and per class assessment
  - Depends on the intra field heterogeneity
- Characteristic selection
  - Still to do…
  - Only spectral values used at this point
- Bi-modal iterative trimming
  - Use EM algorithm for bi-modal parameters
  - Likelihood treshold

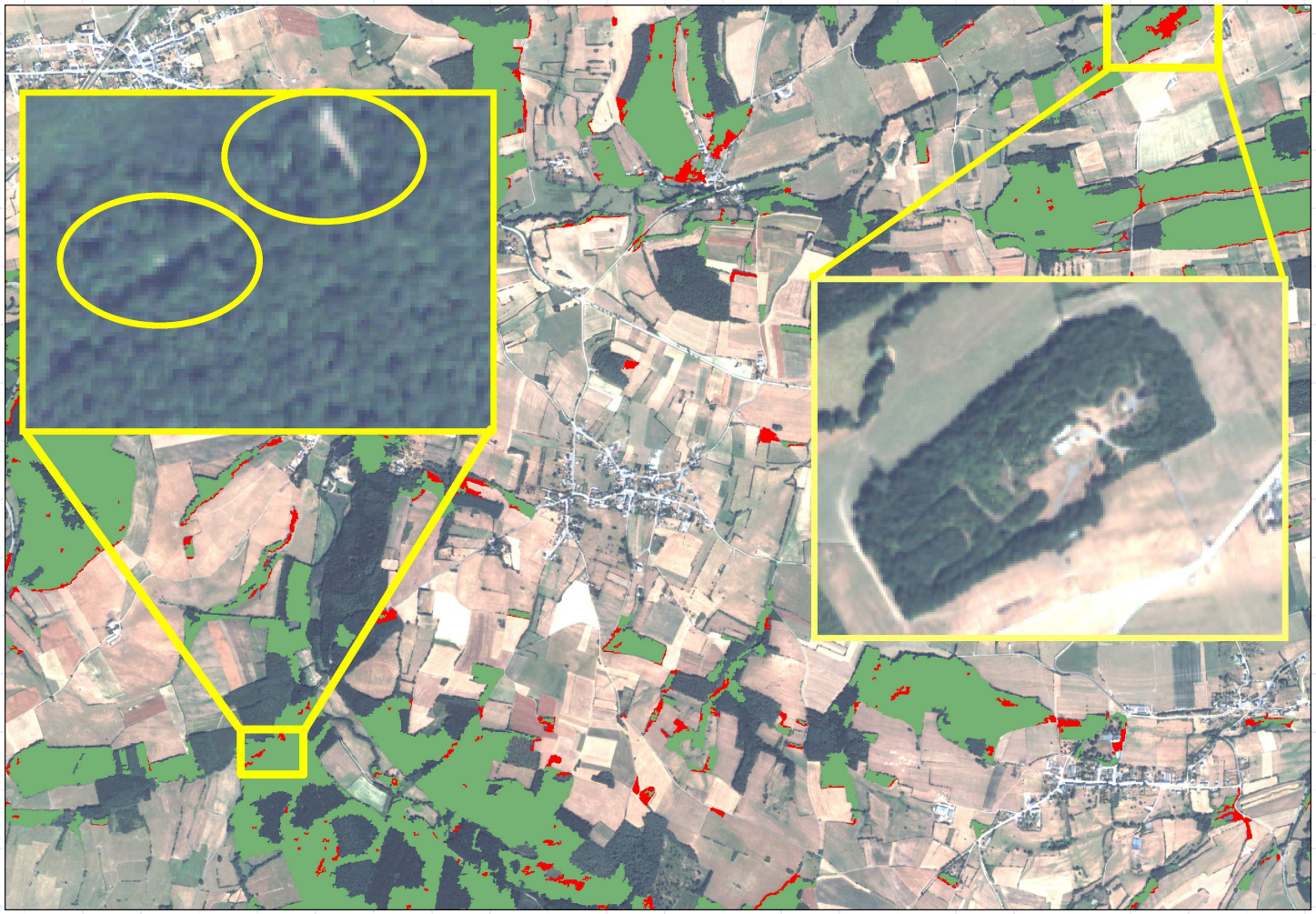
Iterative trimming

- Assumes that outliers in the distribution are discrepancies

1. Evaluate distribution parameters
    1. Bi-modal distribution (EM algorithm)
    2. Multinomial Gaussian
2. Log-likelihood test for the best distribution
3. Run until no more outliers

4. Calculate likelihood with final parameters

Application example : forest change



Conclusion and perspectives

- Good complementarity between the 2 parts
- Method detects thematic and planimetric discrepancies, but…

1. Overdetection

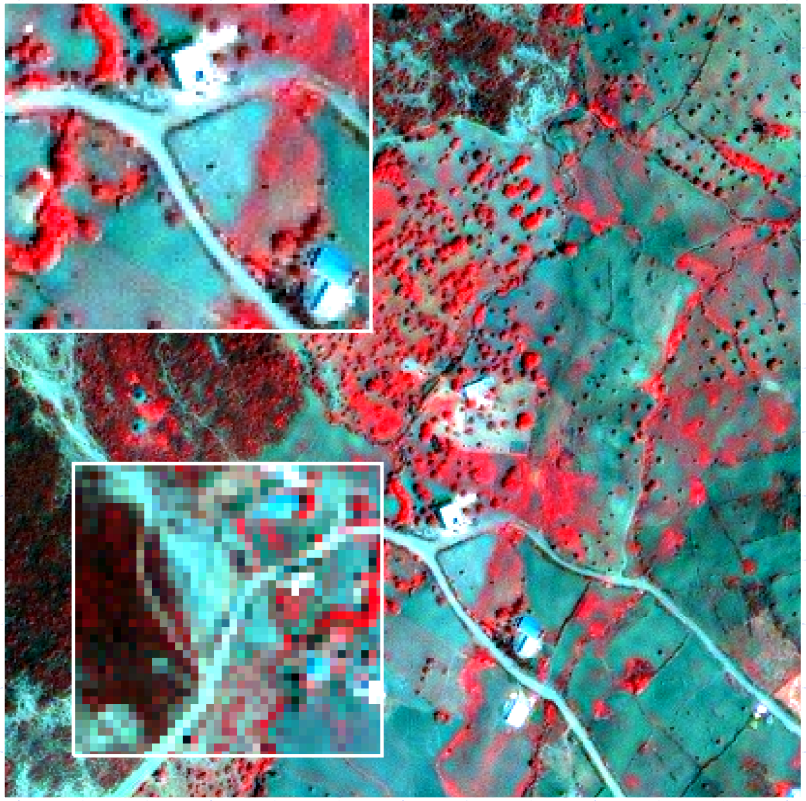
→ Need to classify discrepancies (hope to see you in 2009)

2. Not appropriate for linear objects
   - Use other methods (snakes, filters…)
3. Validation is a real issue
   - Change, artefacts, fuzzy boundaries, semantic…

Pansharpening tool for OTB

- Bayesian data fusion
  - Fasbender, Radoux and Bogaert
- Works with any optical image
  - Particularly good with VHR
- Adaptable
  - Tuning between « color » and « details »
    - Optimized for the application
    - Optimized for the study area

Urban and rural examples



Thank you for your attention