FLOODMAP - Automatic detection of Flooded areas on ASAR images using OOC and ACA

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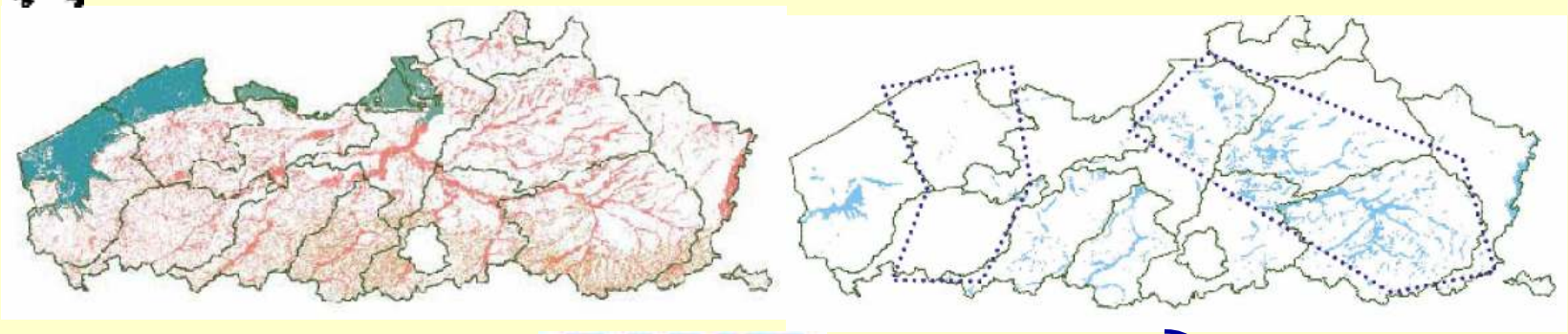
Introducing the problem

- Active Contour Algorithm (ACA)
- Object Oriented Classification (OOC) technique

Geoportal:
www.gisvlaanderen.be/geo-Vlaanderen

Introducing the problem

NOG/ROG (1988-2000) --> Automatic flood detection on ASAR



Administratie Waterwegen en Zeewezen

Waterbouwkundig Laboratorium en Hydrologisch Onderzoek

Validation of models

- One year project financed by:

VLAANDEREN

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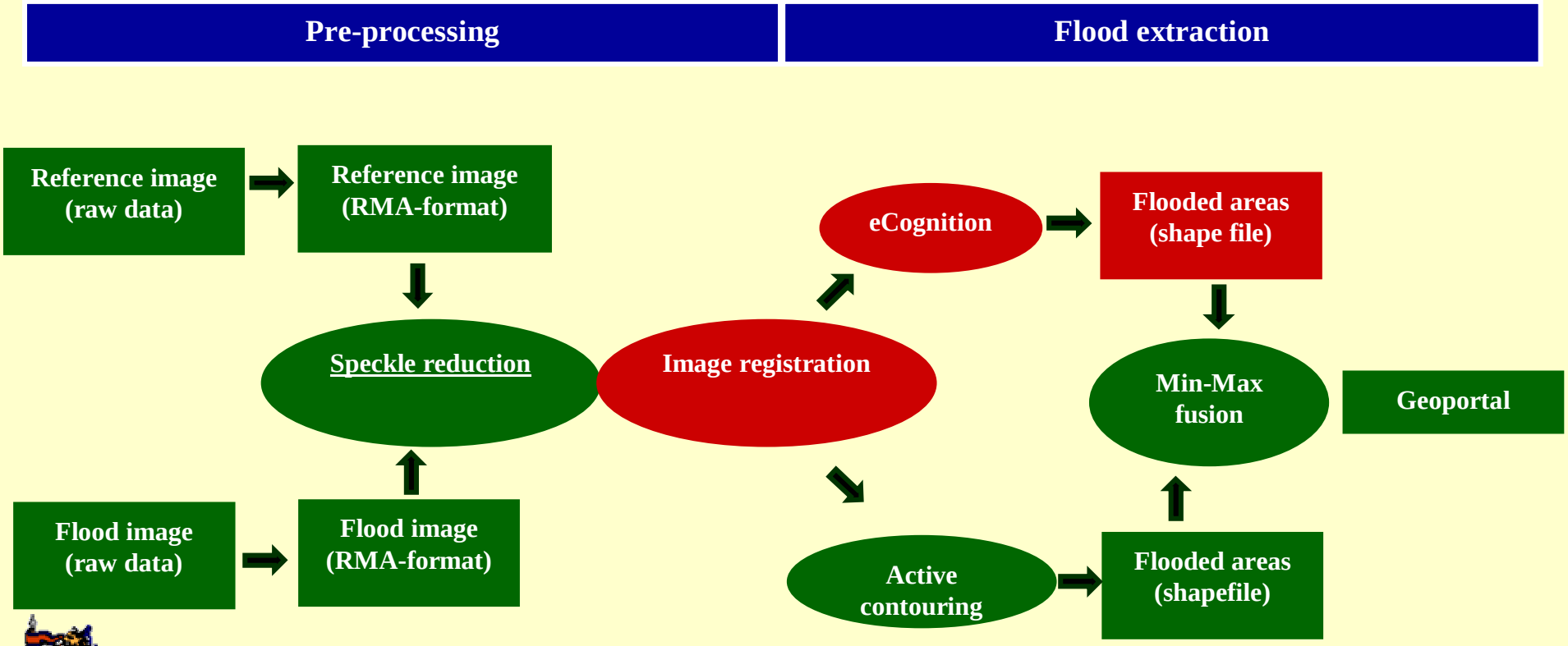
FLOODMAP FLOWCHART DIAGRAM

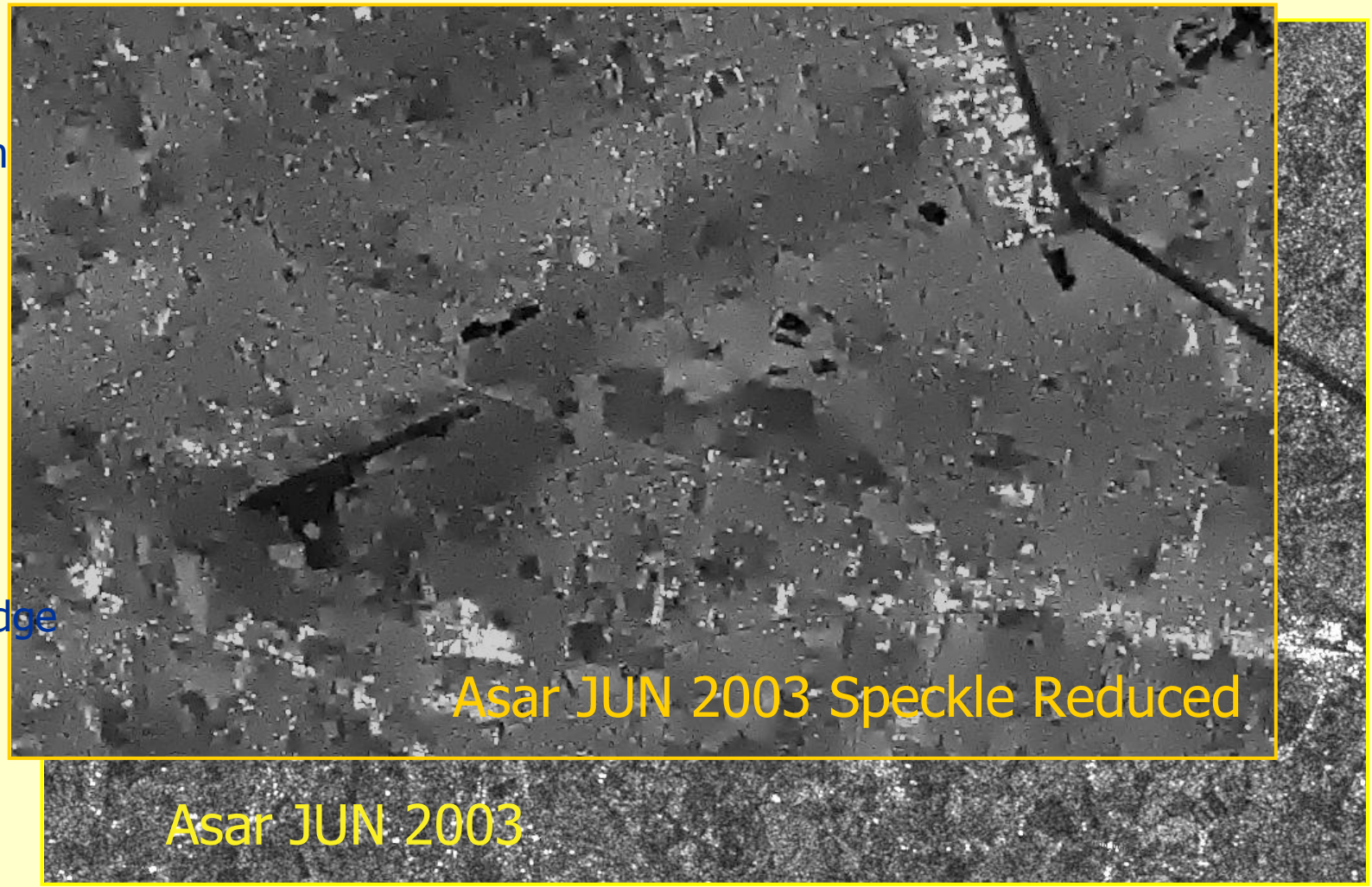


Speckle Reduction (shown on JUN03)

- Noise ~ exp
- Signal ~ gam

Threshold Wav. Coeff

- Prior knowledge using MRF



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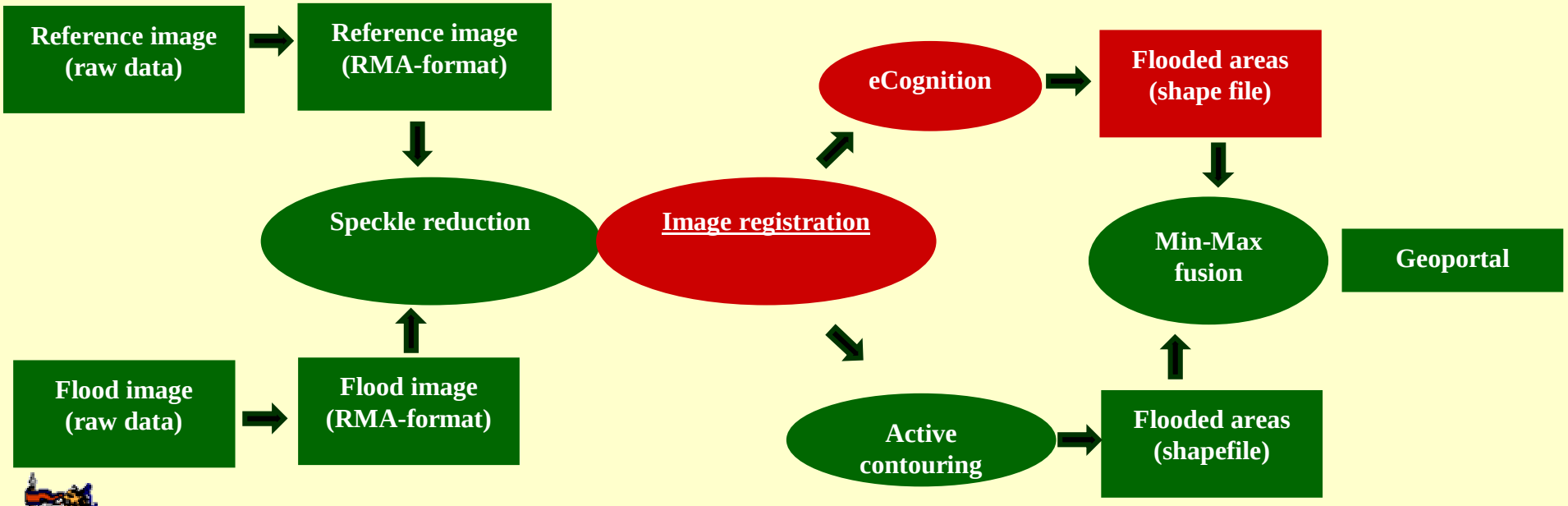
Pre-processing
Flood extraction
Reference image (raw data)
Reference image (RMA-format)
Speckle reduction
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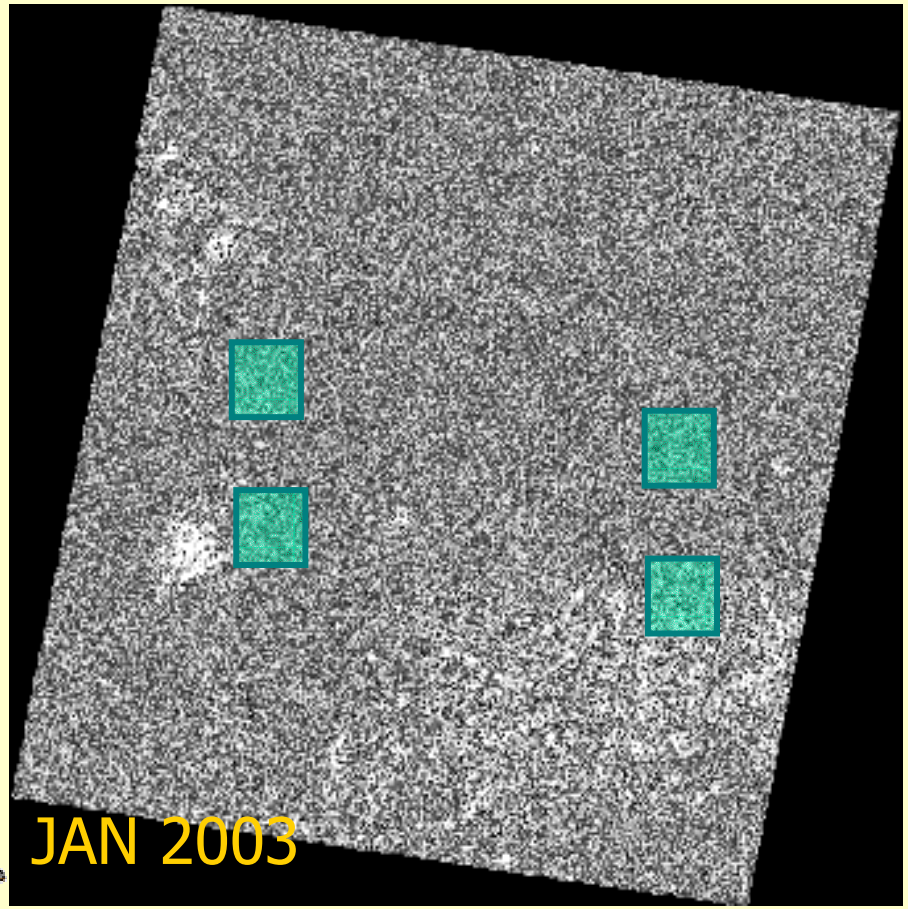
Georeferencing: ASAR(JAN03)-Topog

- Affine Transformation

$$\begin{cases} x_W = A_1 + B_1 x_I + C_1 y_I \\ y_W = A_2 + B_2 x_I + C_2 y_I \end{cases}$$

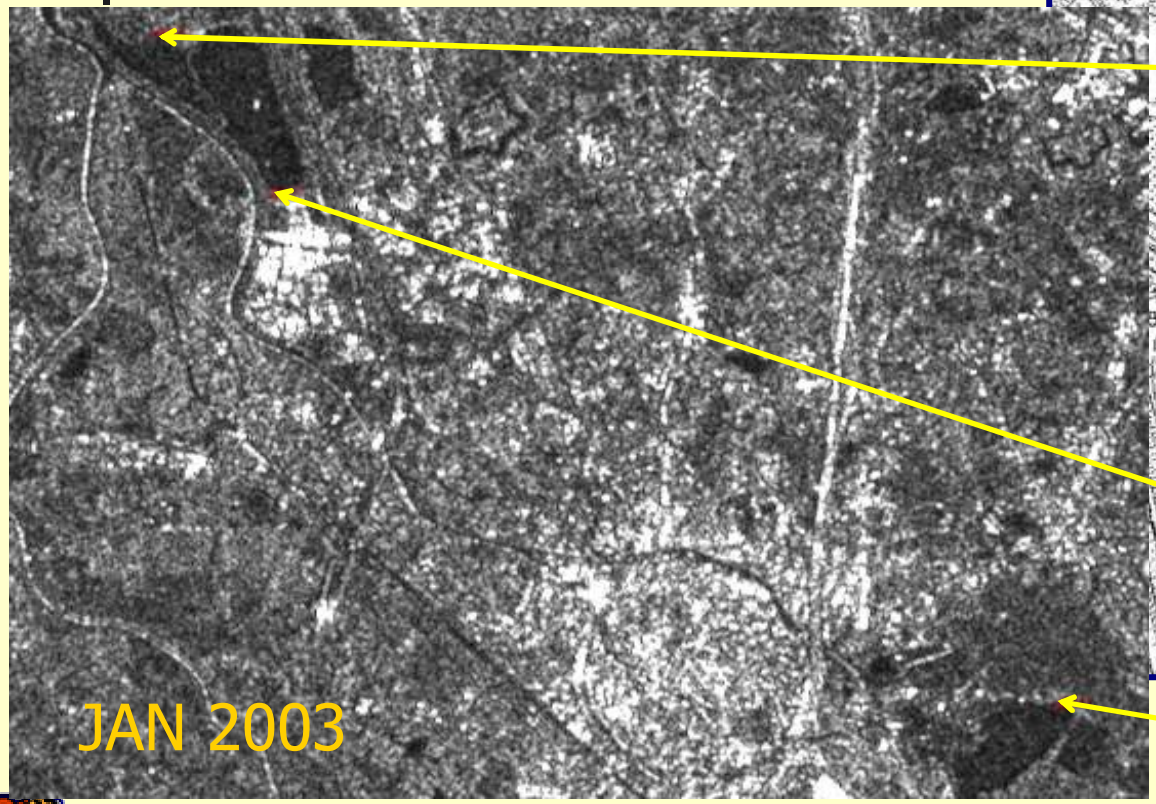


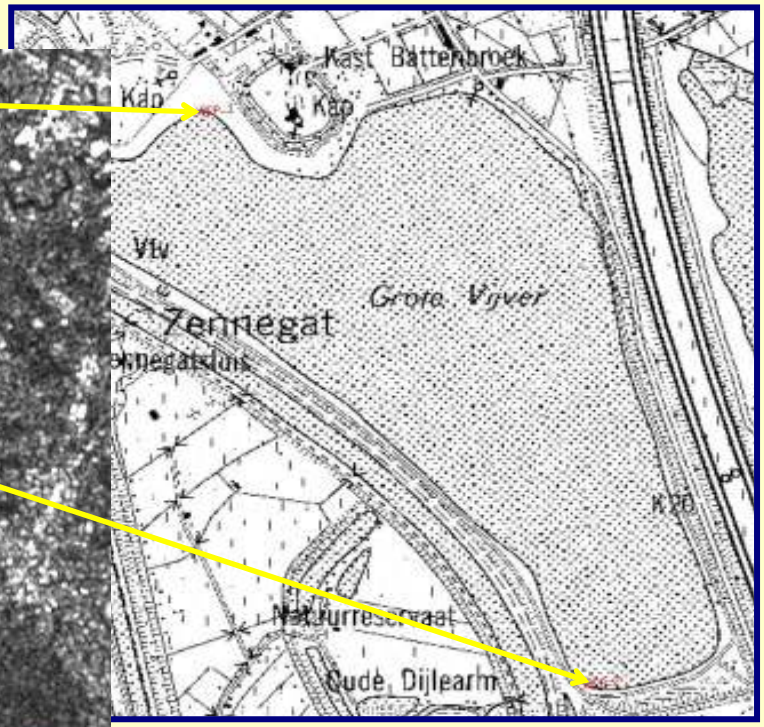
- 8 GCPs on ASAR(JAN03) & 8 cor. GCPs on **topog.**

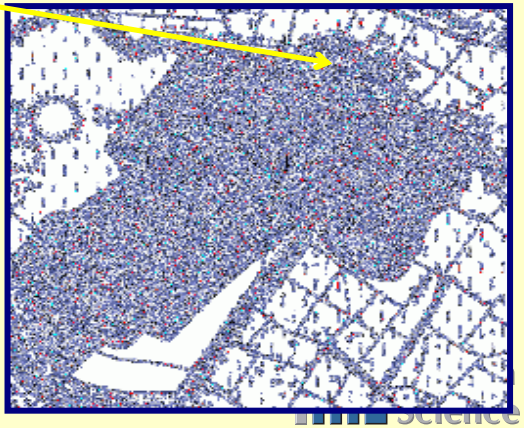
(topog + tfw)

Determination of parameters

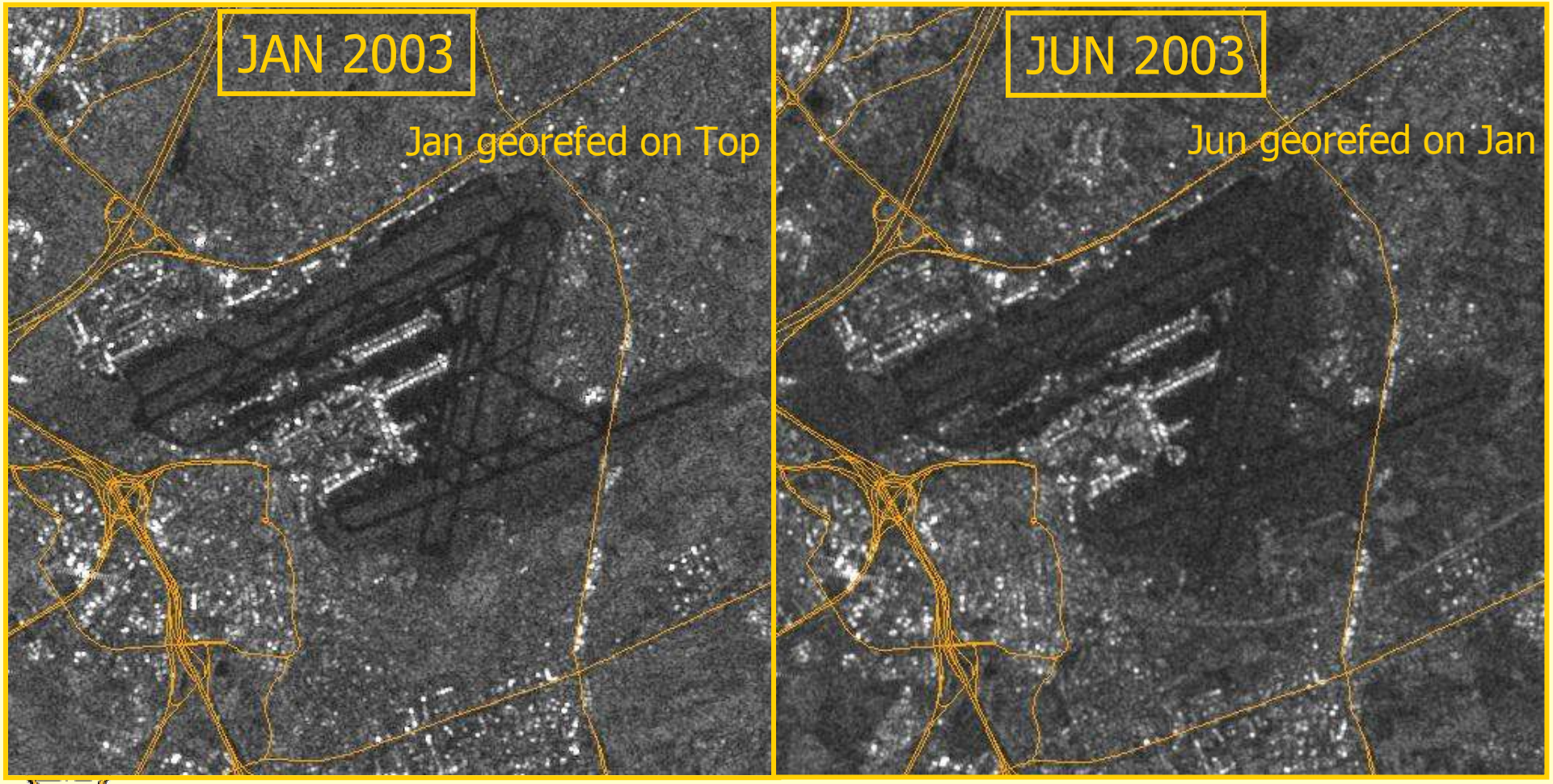
Georeferencing: GCP-matchings (ASAR-TopoMap)

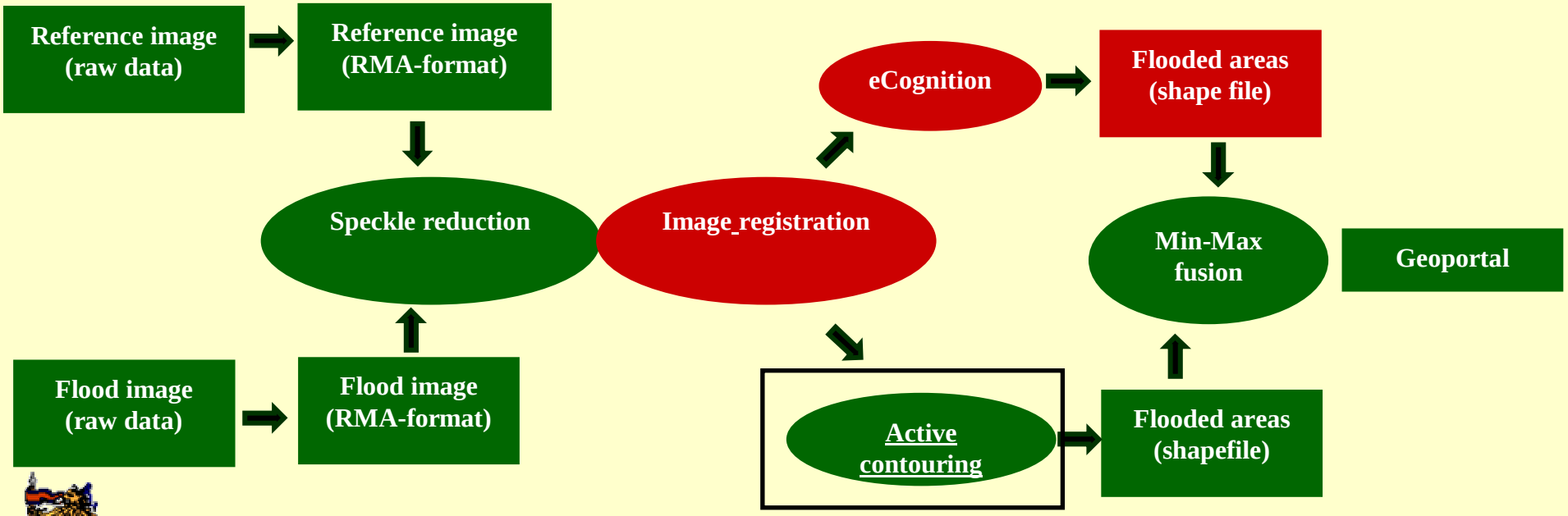






Georeferencing: Result

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Active Contour Technique

Initial AC Polygons

(Input)

- Binary (Thr ~200)
- Math Morph Erosion (st.el. square 5x5)
- Math Morph Dilatation (st. el. square 3x3)
- Region2Obj

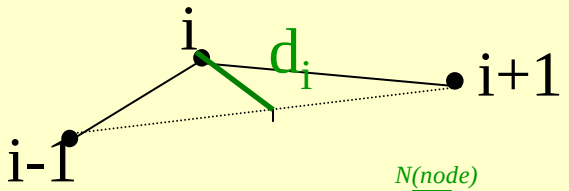
- Active Contour ⟶ Diff between 2 scenes (Flooded–NonFlooded).

Active Contour Formalism

$$E(p,\lambda) = (1-\lambda)\left[N_{in}\ \log_{10}\left(\sigma_{in}^2\right) + N_{out}\ \log_{10}\left(\sigma_{out}^2\right)\right] + \lambda U_{in}$$

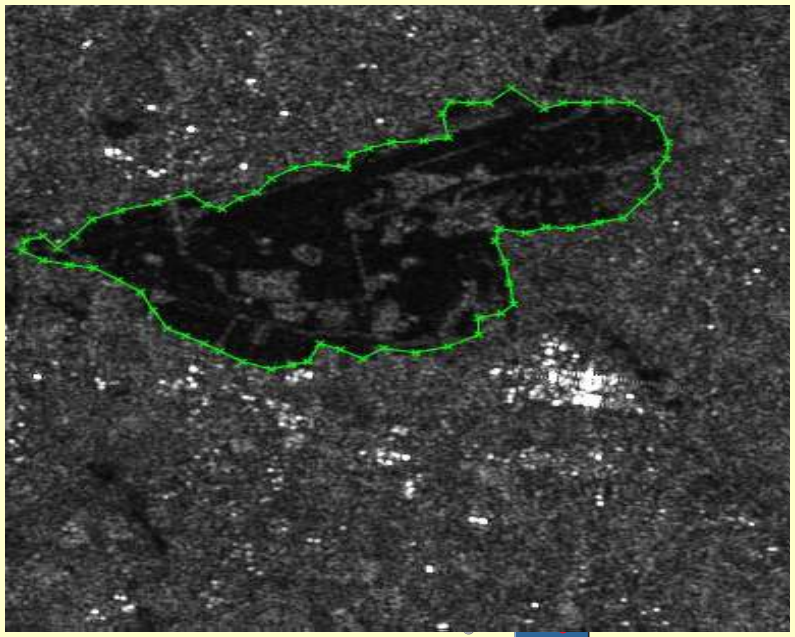
$$m_{in} = \frac{1}{N_{in}} \sum_{i \in in} x_i \qquad \sigma_{in}^2 = \frac{1}{N_{in}} \sum_{i \in in} [x_i - m_{in}]^2$$

$$m_{out} = \frac{1}{N_{out}} \sum_{i \in out} x_i \qquad \sigma_{out}^2 = \frac{1}{N_{out}} \sum_{i \in out} [x_i - m_{out}]^2$$



$$U_{in} = \sum_{i=1}^{N(node)} d_i$$

- Iteration L1(NrIt, RanDispl, λ)
- Add nodes (d1Max)
- Iteration L2(NrIt, RanDispl, λ)
- Add nodes (d2Max)
- Iteration L3(NrIt, RanDispl, λ)



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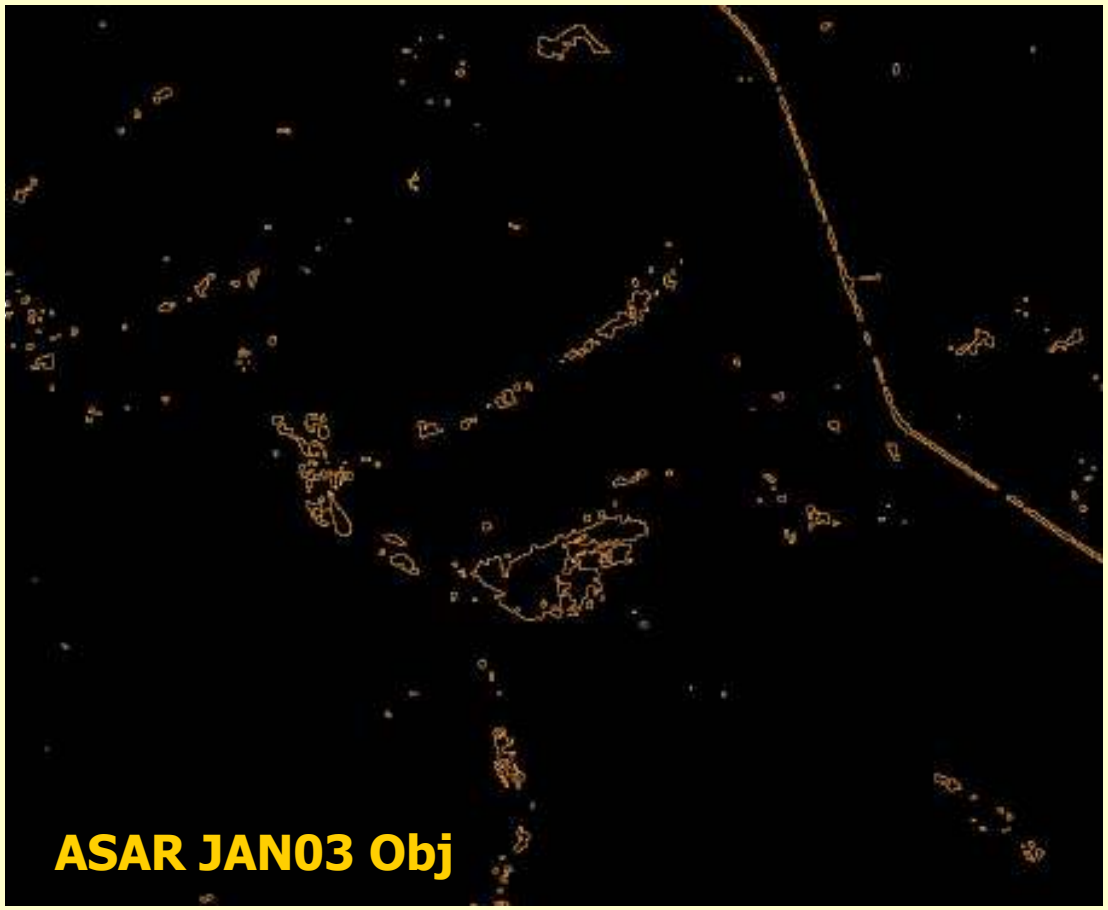

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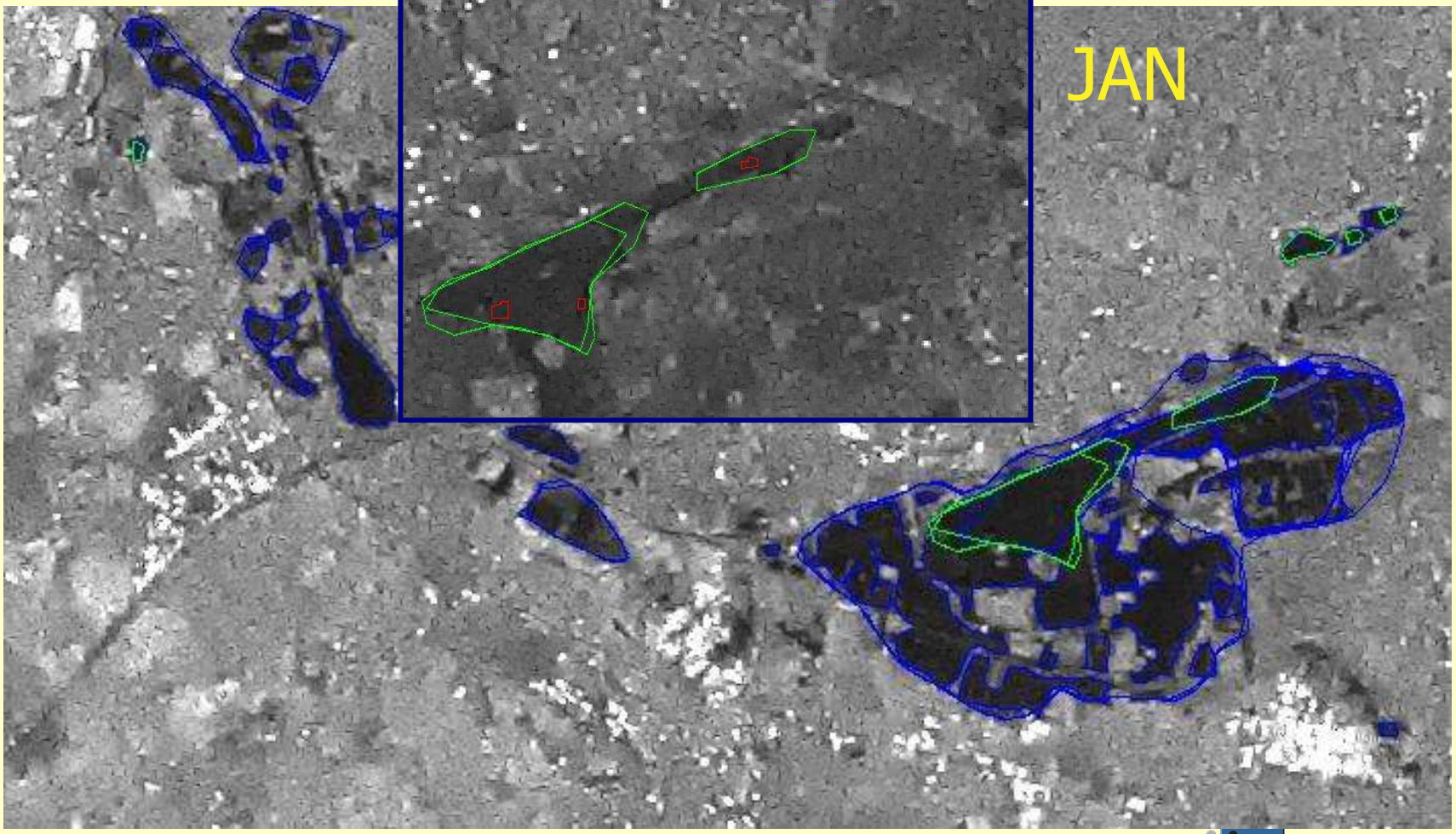
Active Contour Result



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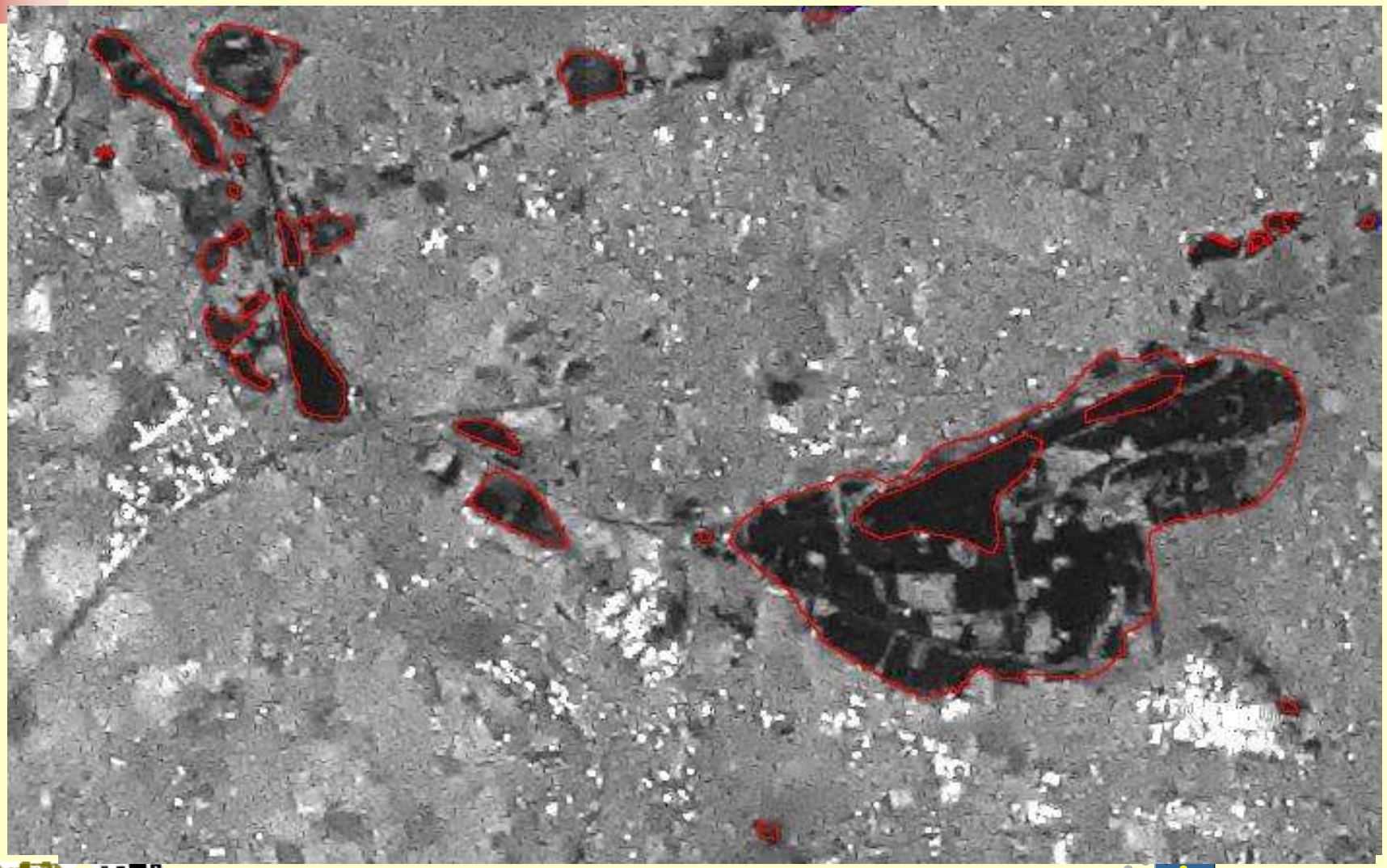
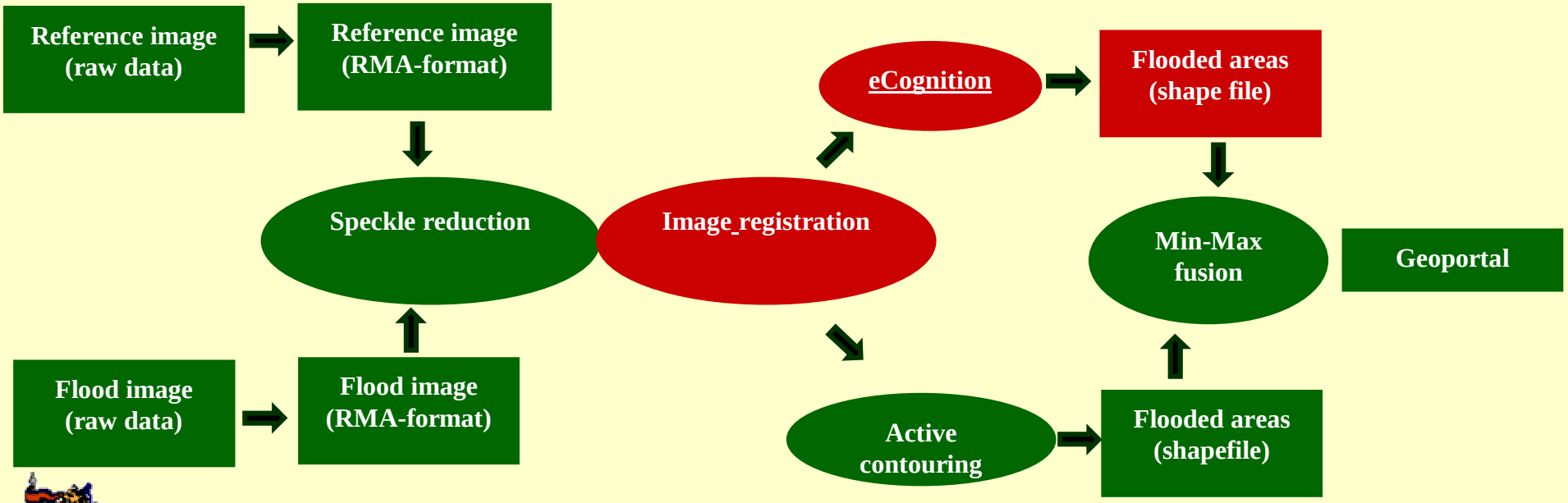
Difference: Jun-Jan

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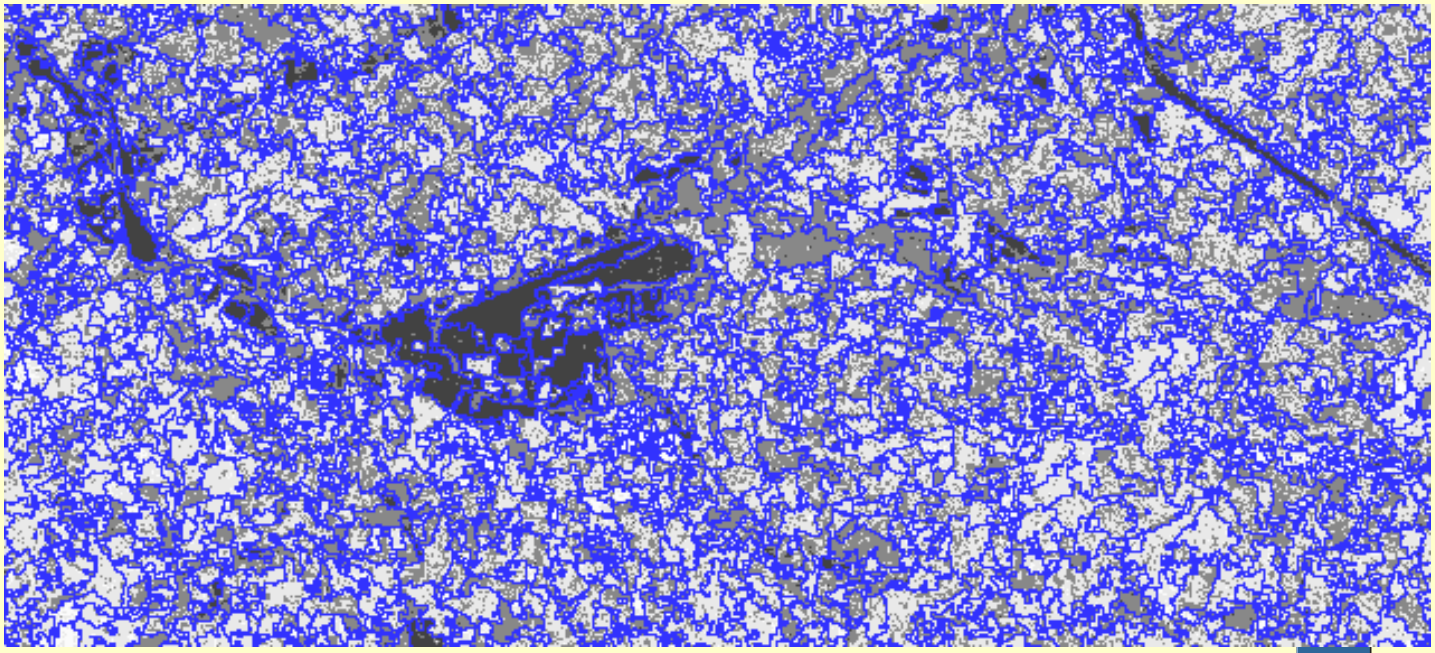
Object Oriented Technique

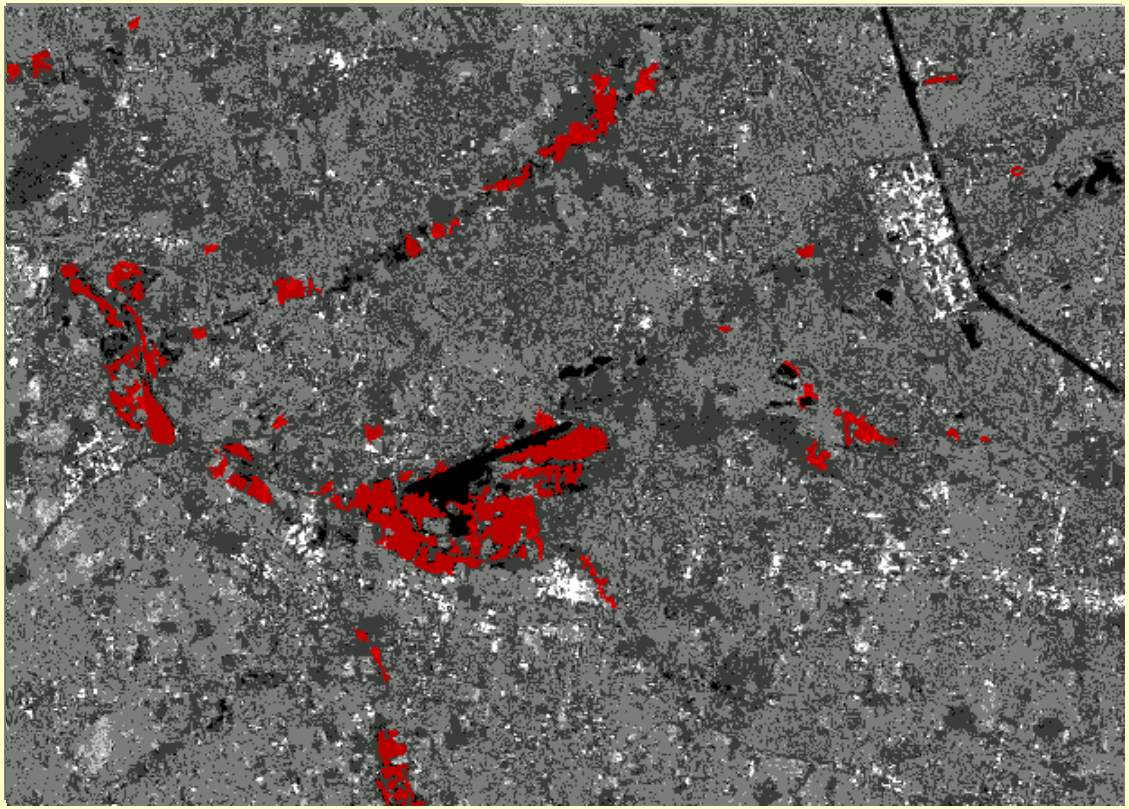
- Segmentation FloodImg & RefImg
  - Scale parameter 50
  - Homogeneity (70% color, 30% shape)
  - Shape (90% Smoothness, 10% Compactness)



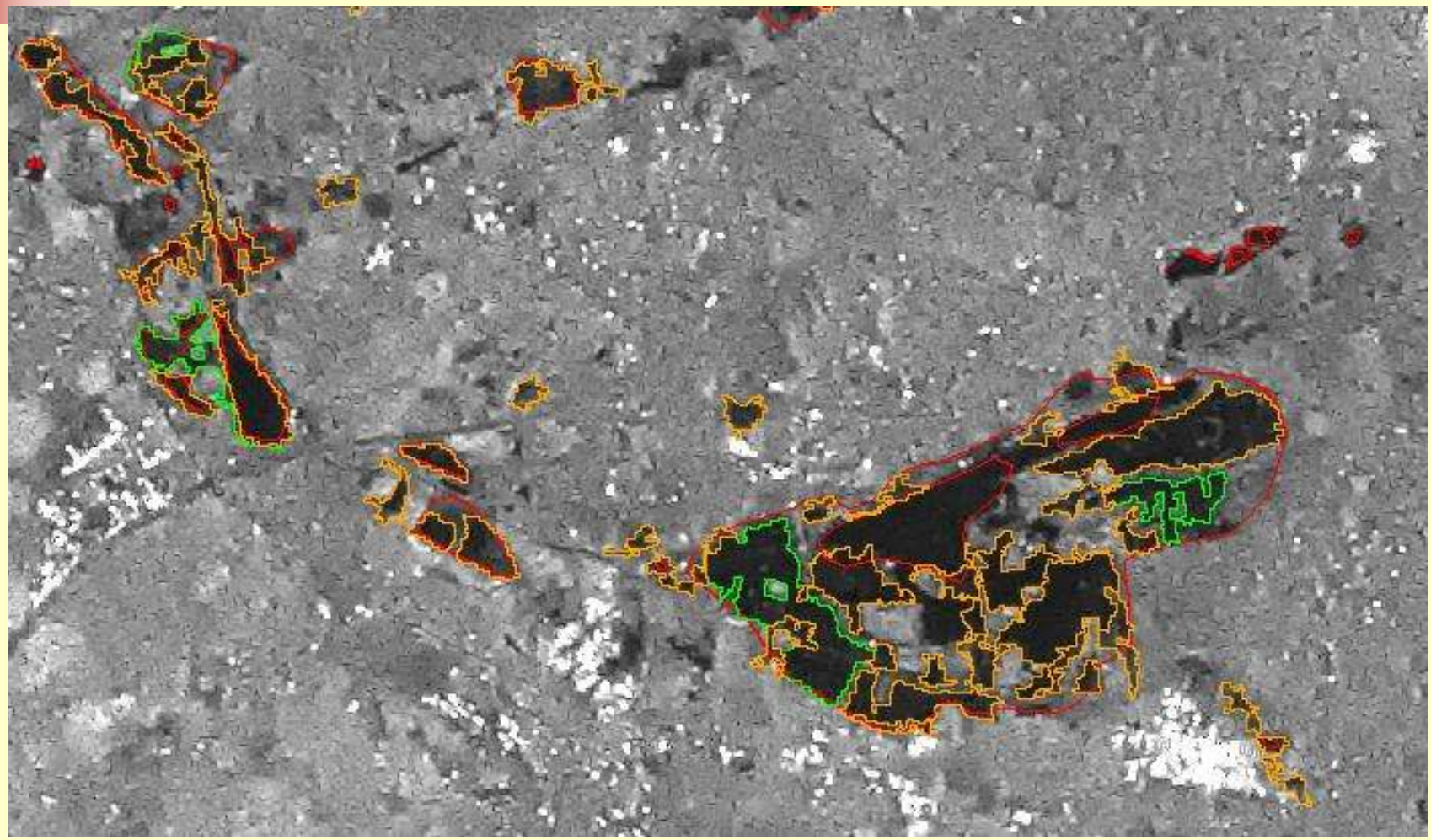
Classification (2 Steps)

Step 1: Object extraction with $\mu 1 < 210$ from FloodImg (JAN03)

Step 2: Retain Objects with $\mu 2 - \mu 1 > 70$



Comparison ActCont versus eCognition



Results on Geo-Portal

Selecteer de lagen

Overstromingsgebieden (NOG en ROG zichtbaar vanaf schaal 1/200.000)

- ☐ Van nature overstroombare gebieden (NOG)
- ☑ Recent overstroomde gebieden (ROG)
- ☑ Risicozones voor overstromingen (voorlopige afbakening)

VHA basislagen

- ☐ Bekkens
- ☐ Subhydrografische zones (VHA-zones)
- ☑ Waterlopen en Waterwegen

Algemene Referentielagen

- ☑ Gemeenten
- ☑ Provincies

Herteken de kaart