

An aerial Synthetic Aperture Radar (SAR) image of a city, likely Paris, showing a dense network of streets and buildings. A semi-transparent grid is overlaid on the image, indicating the segmentation process. The text is centered over the image.

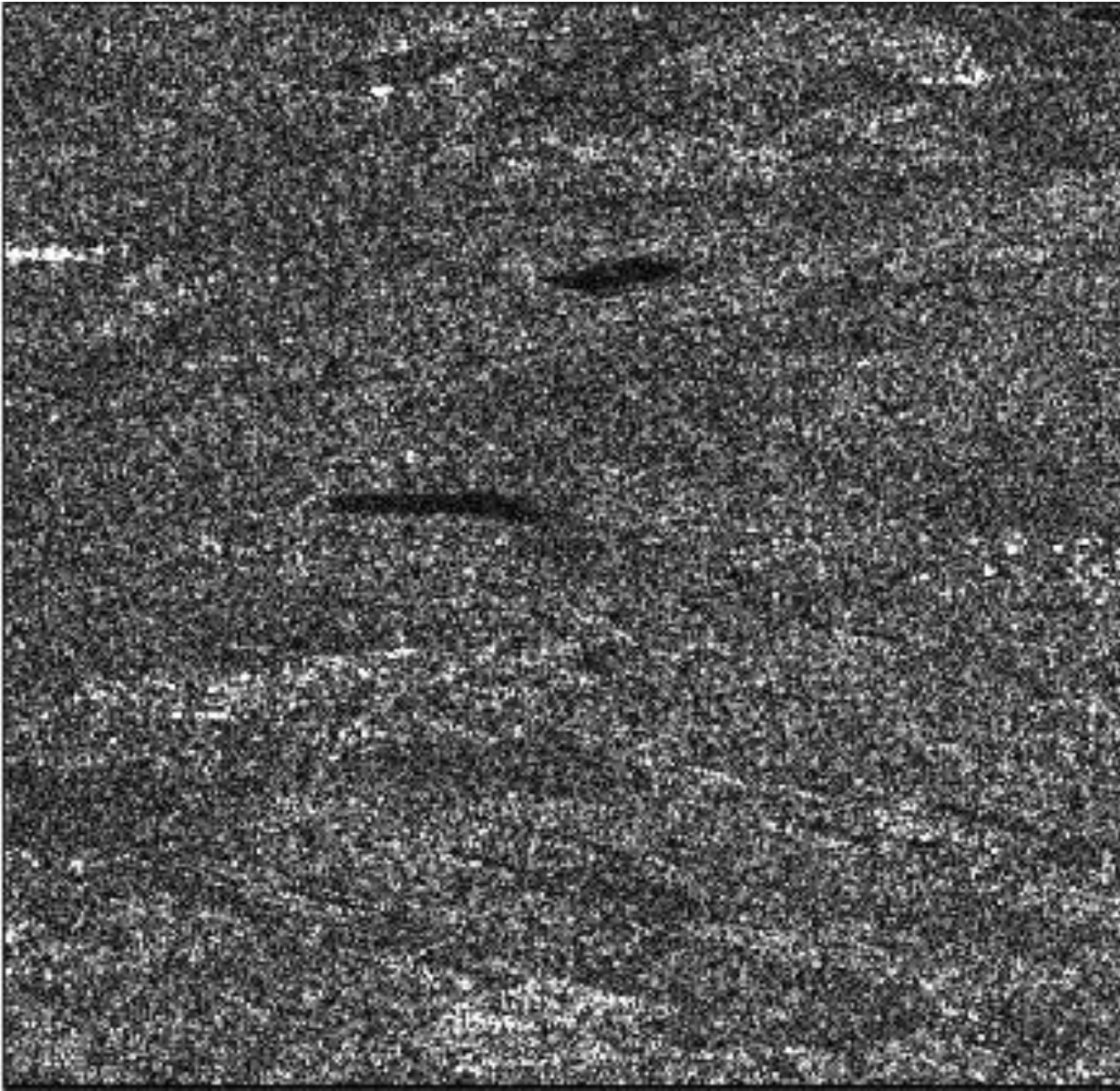
# SEGMENTATION D'IMAGE SAR MULTI-TEMPORELLE

ENCADRANTE: Florence Tupin

- I. Introduction
- II. Contexte
- III. K-means
- IV. SLIC
- V. Résultats expérimentaux
- VI. Conclusions



# INTRODUCTION



SLIC

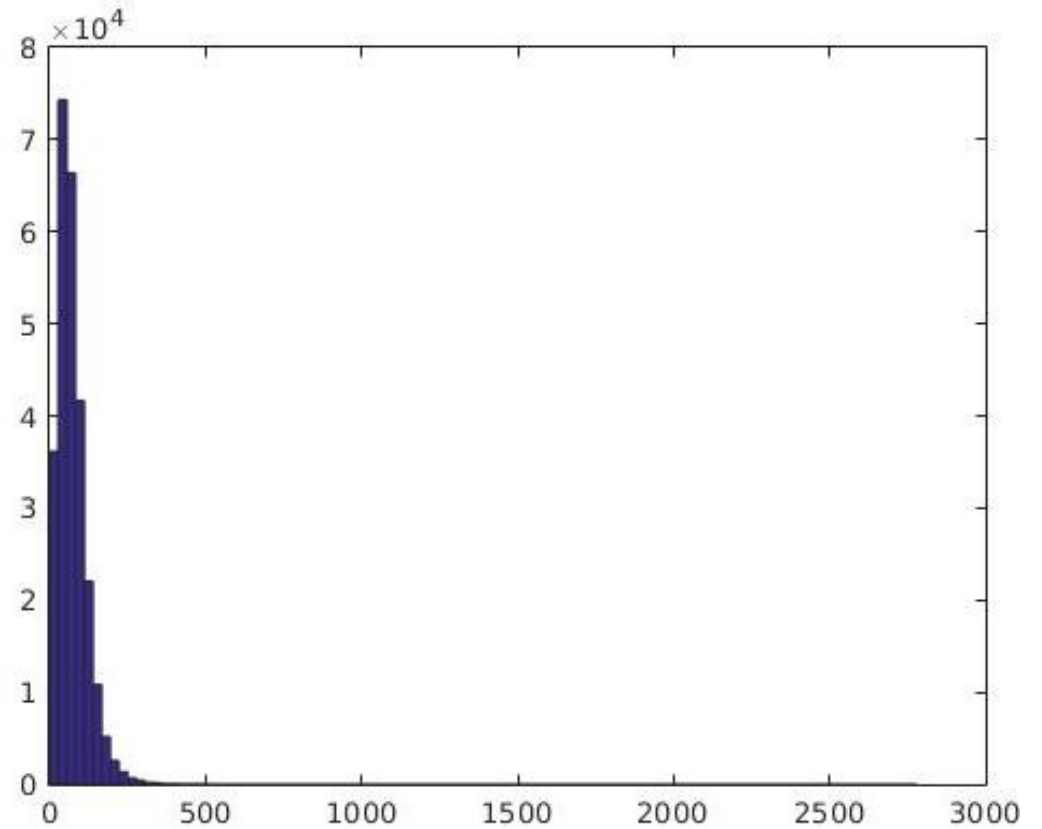
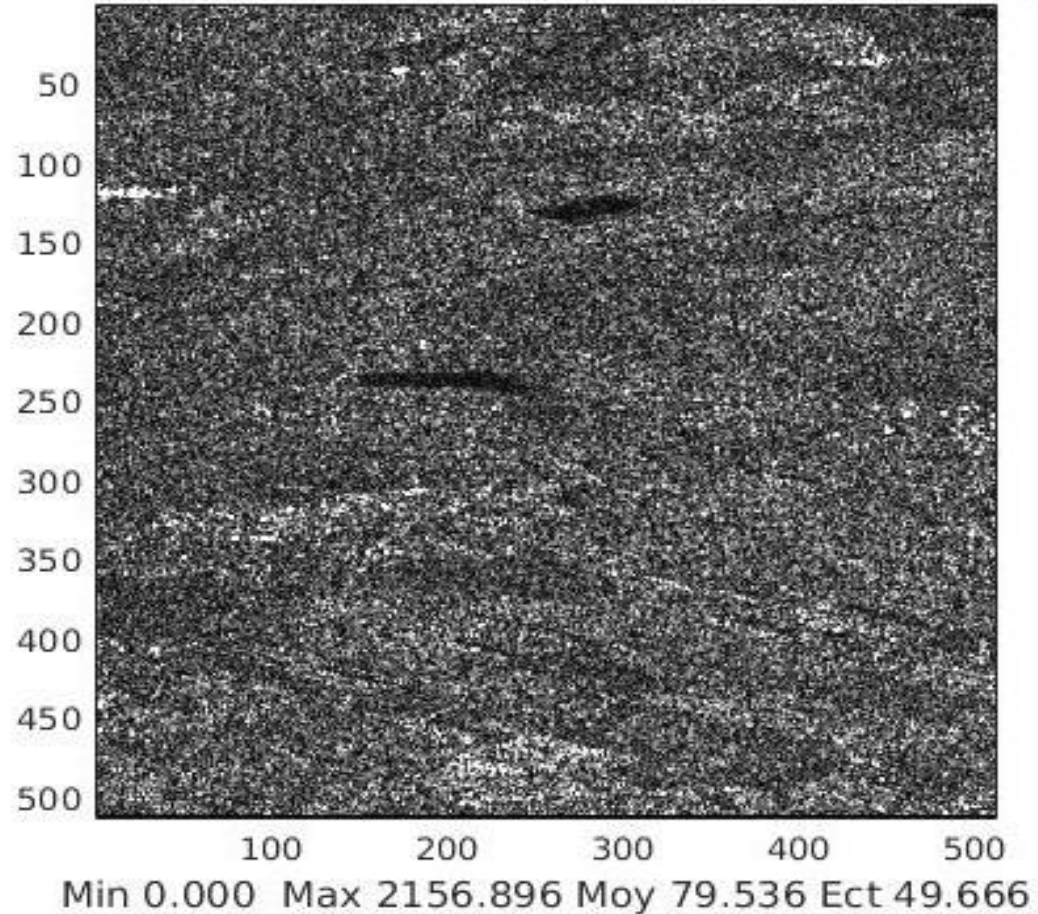




# CONTEXTE

24 images du site de Chenguang

**Image seuilée : valmoy + 3.000 sigma (228.5)**

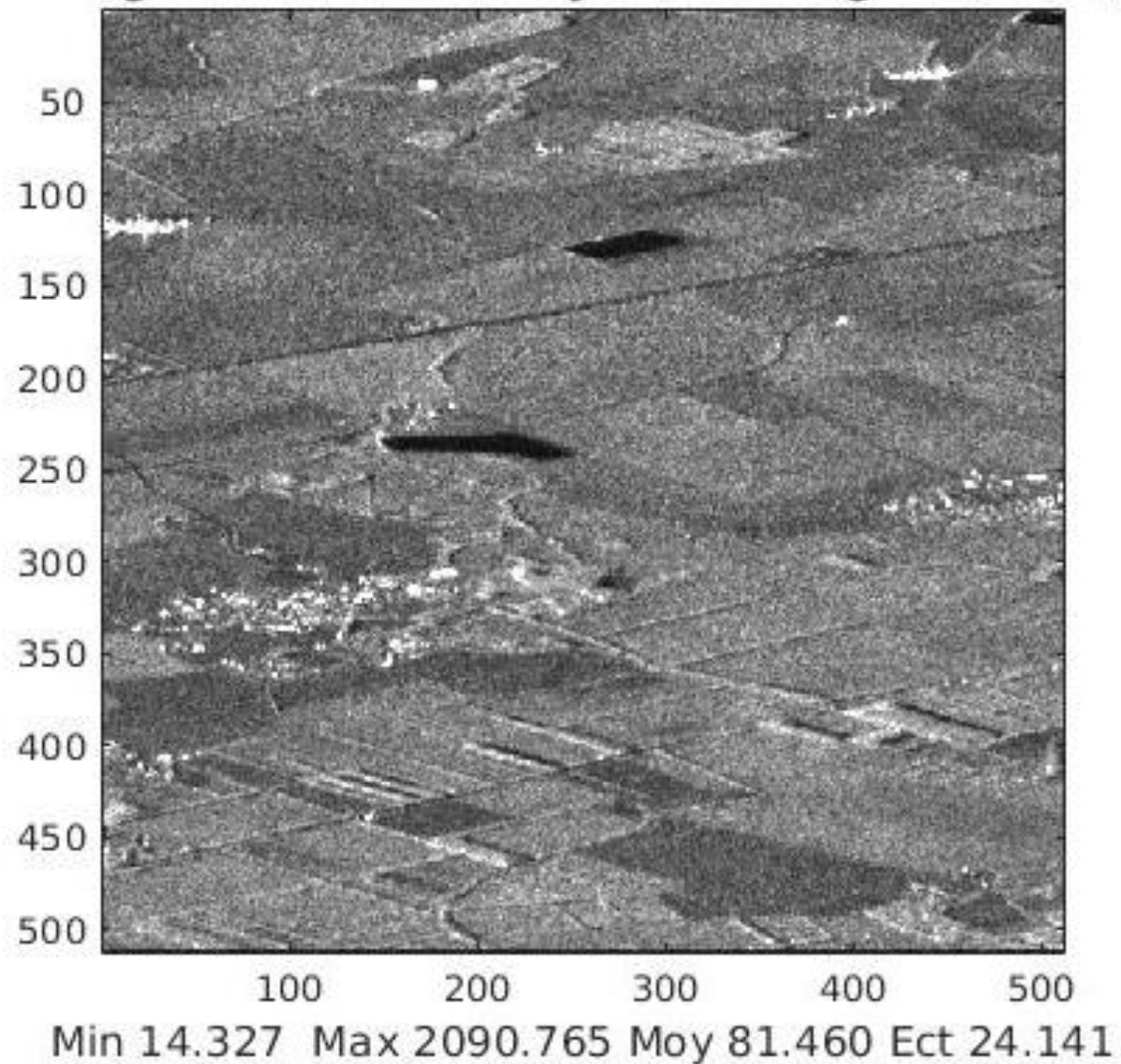


Fonctions de visualisation:

imz2mat.m

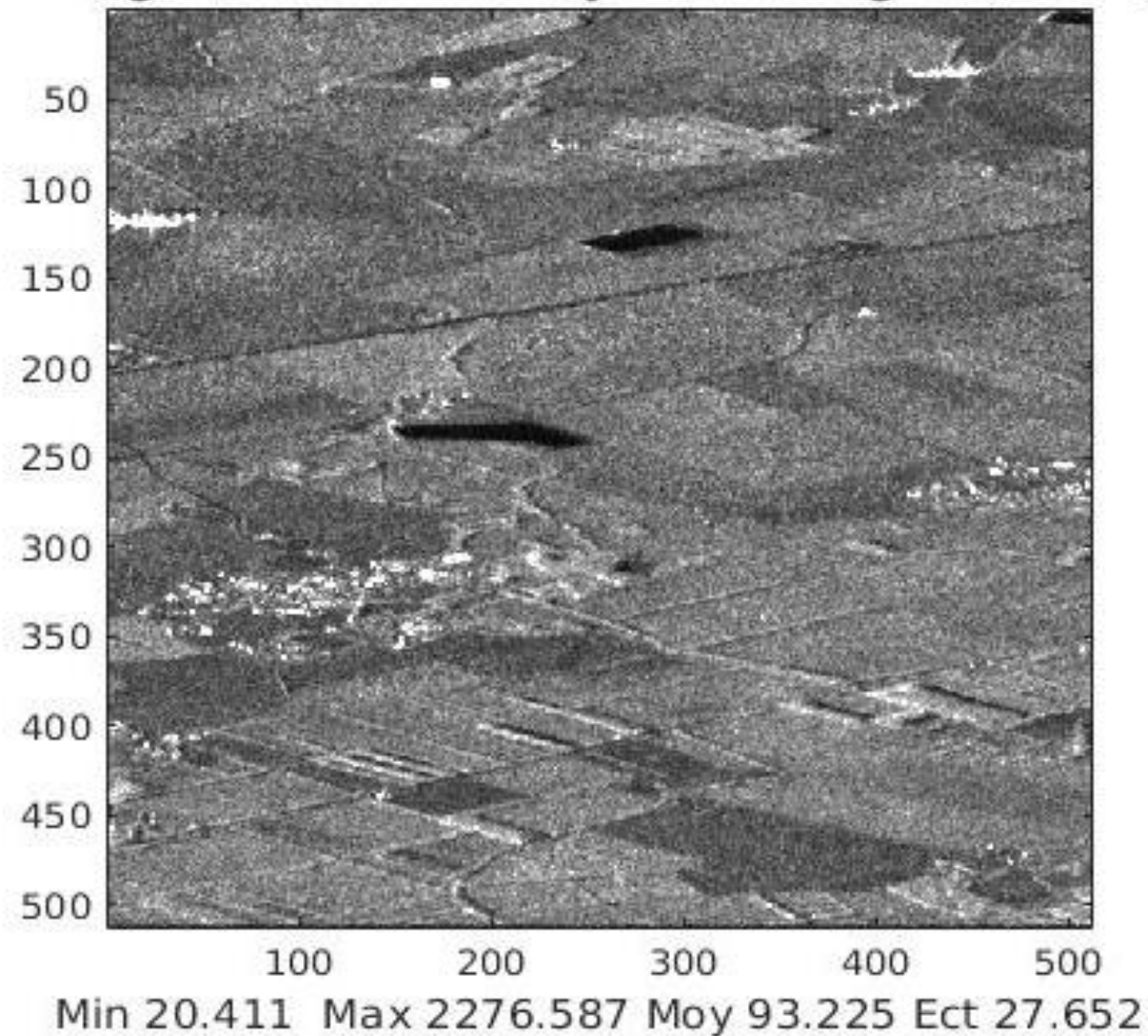
visusar.m

**Image seuillee : valmoy + 3.000 sigma (153.9)**



Moyenne temporelle L1

**Image seuillee : valmoy + 3.000 sigma (176.2)**



Moyenne temporelle L2



Image seuillée : valmoy + 6.000 sigma (2.5)

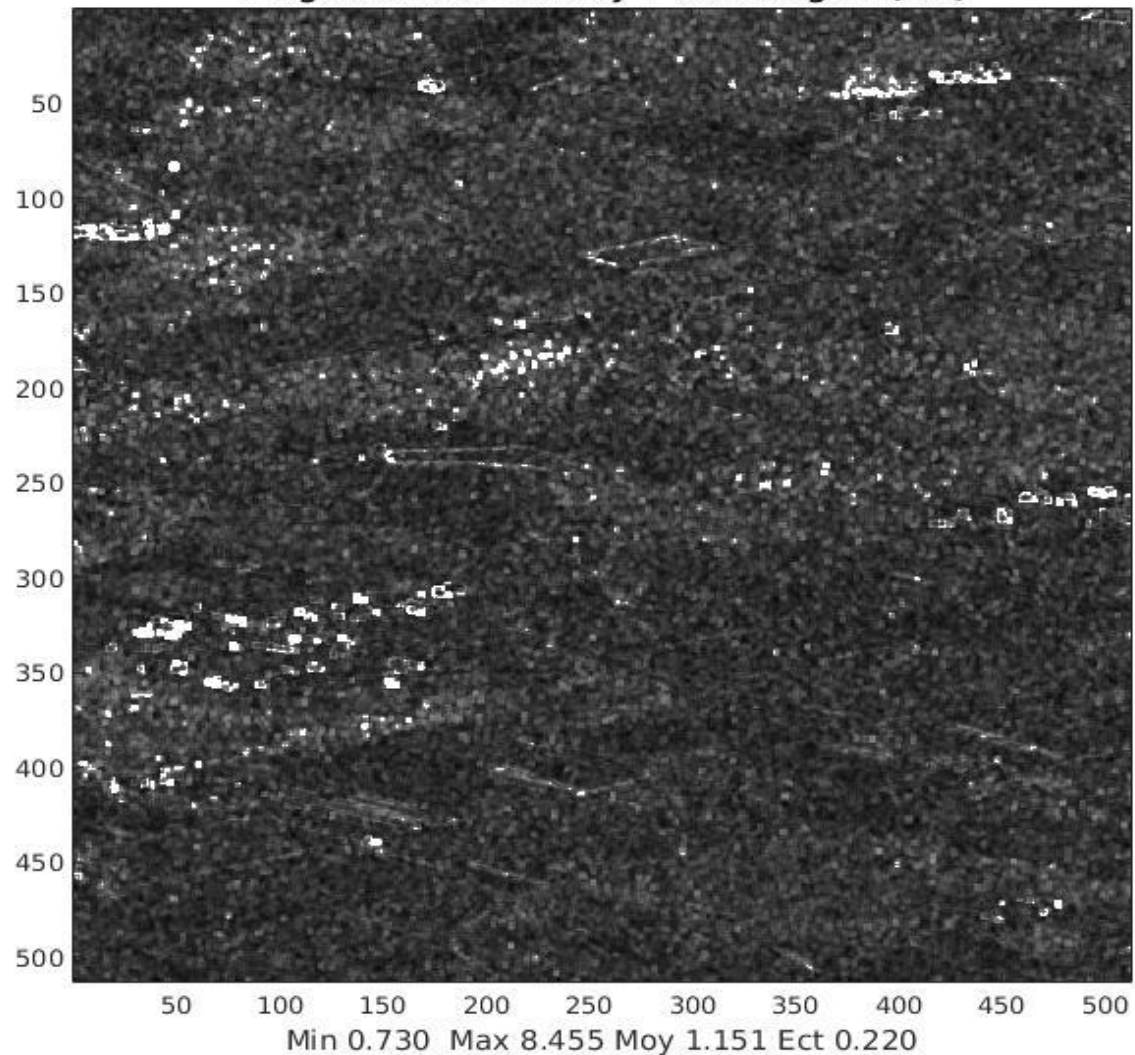
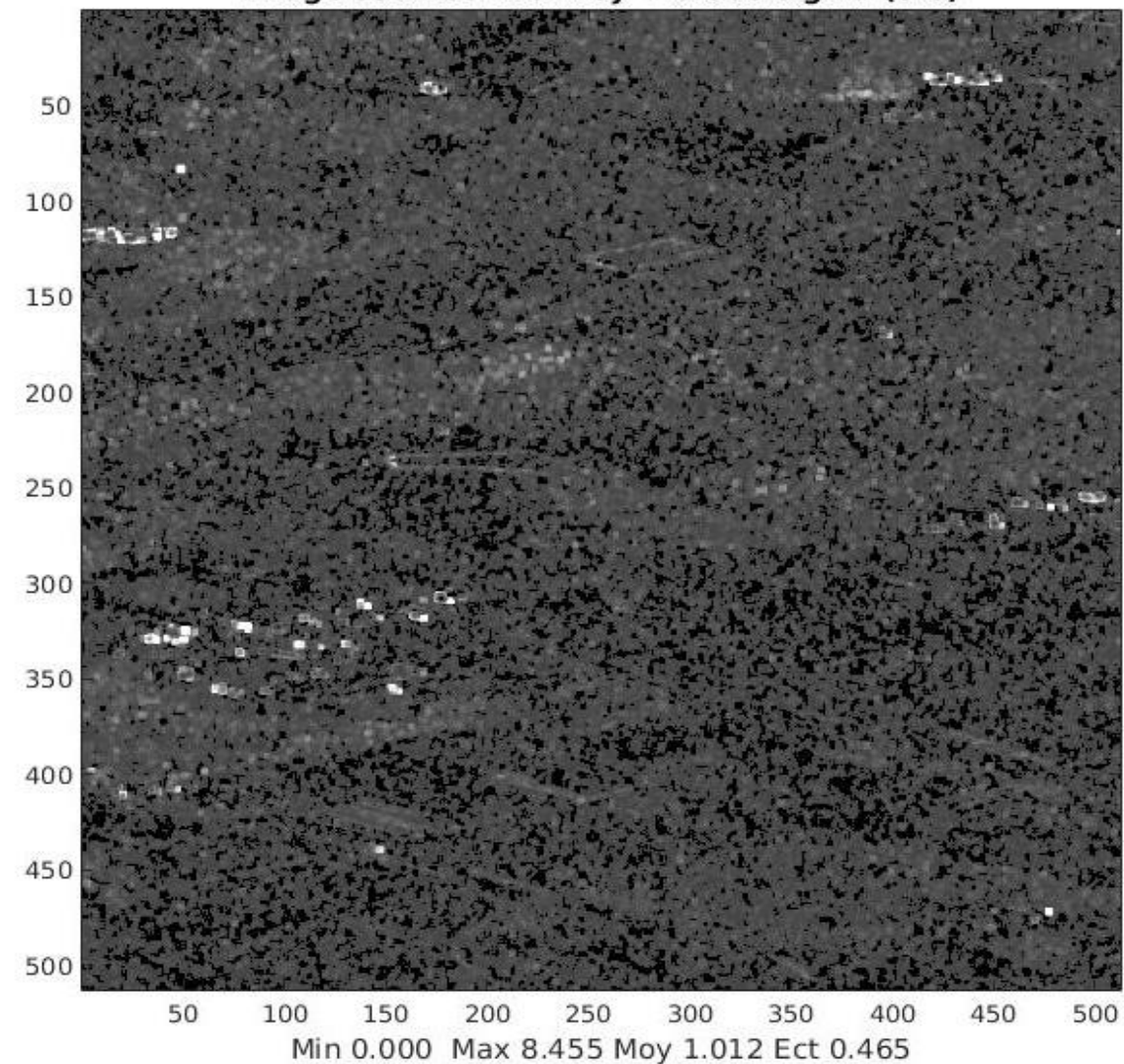


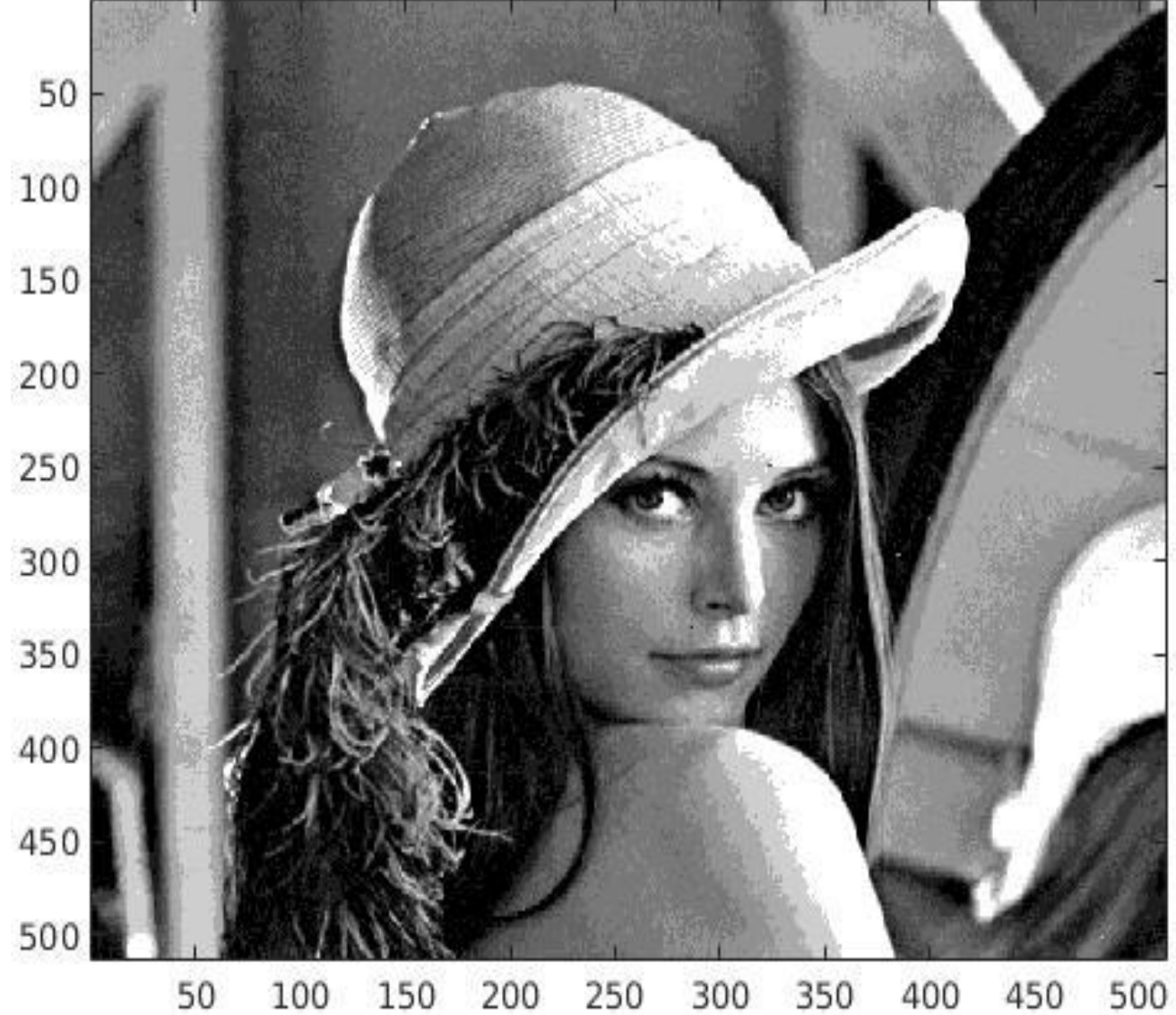
Image seuillée : valmoy + 6.000 sigma (3.8)



Rapport écart-type sur moyenne de l'intensité des 24 pixels multi-temporels

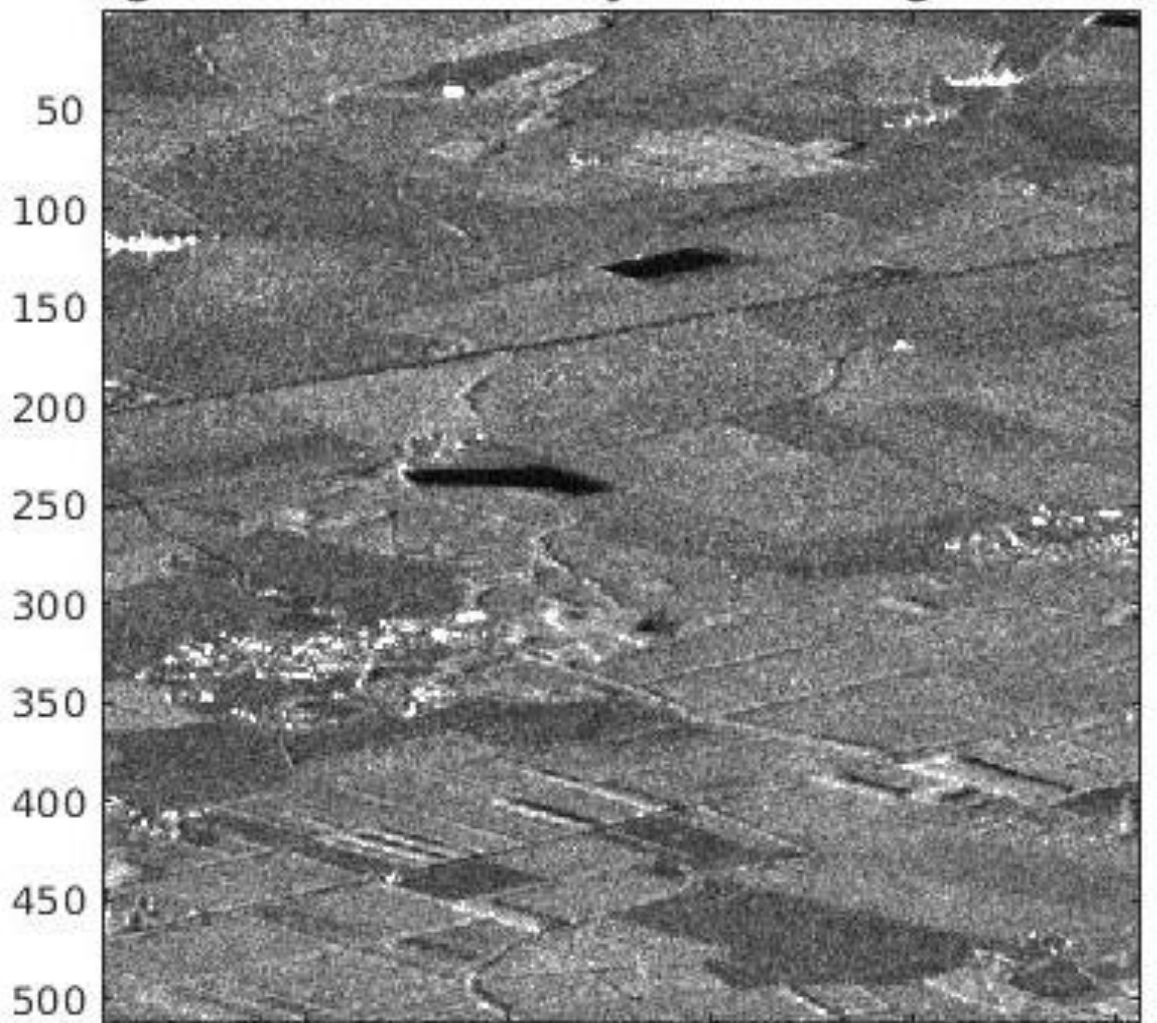
# K-MEANS

K=10



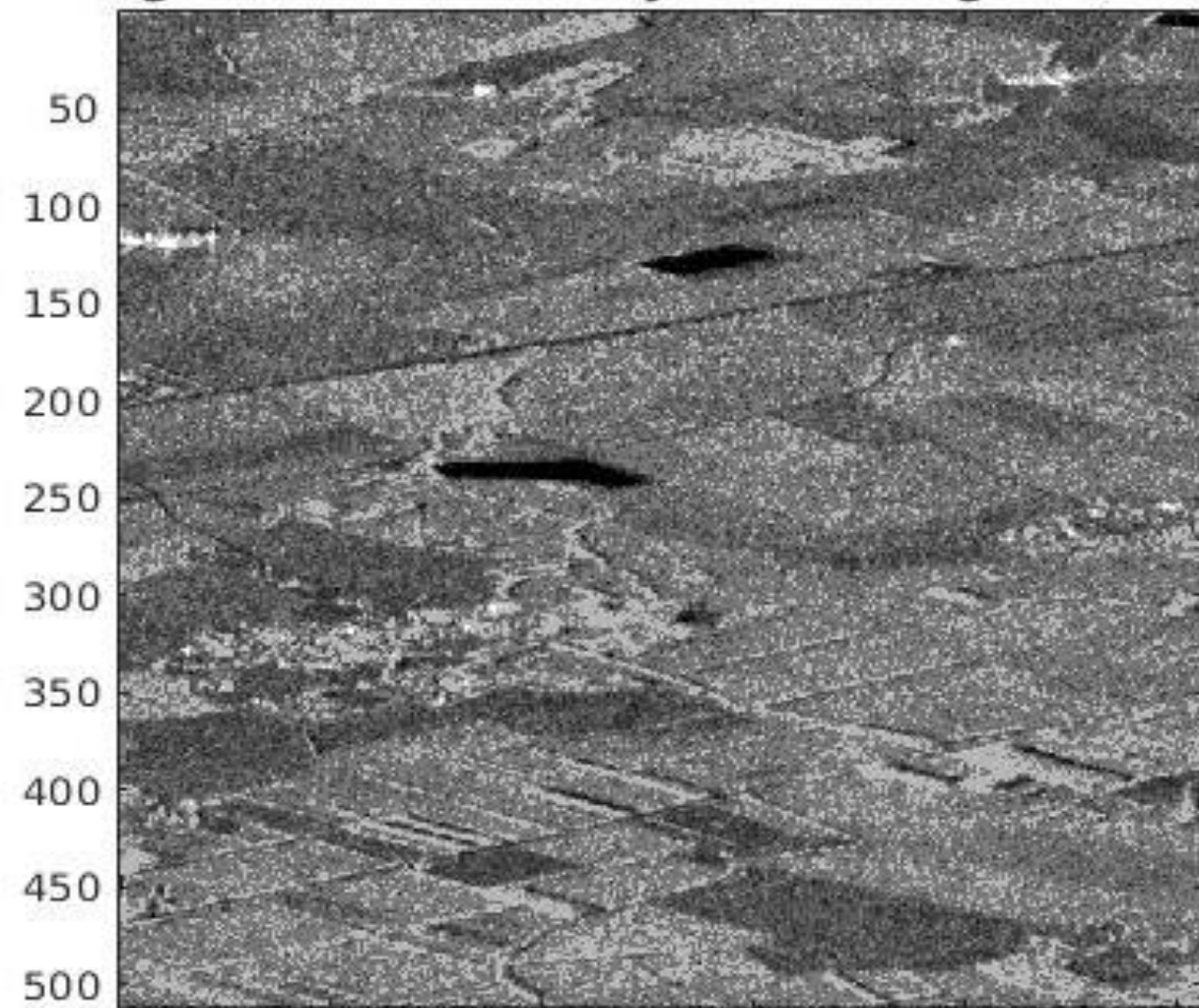


**Image seuillee : valmoy + 3.000 sigma (176.2)**



Min 20.411 Max 2276.587 Moy 93.225 Ect 27.652

**Image seuillee : valmoy + 3.000 sigma (162.4)**



Min 32.377 Max 526.764 Moy 91.528 Ect 23.618

K=10



Image seuillee : valmoy + 3.000 sigma (176.2)

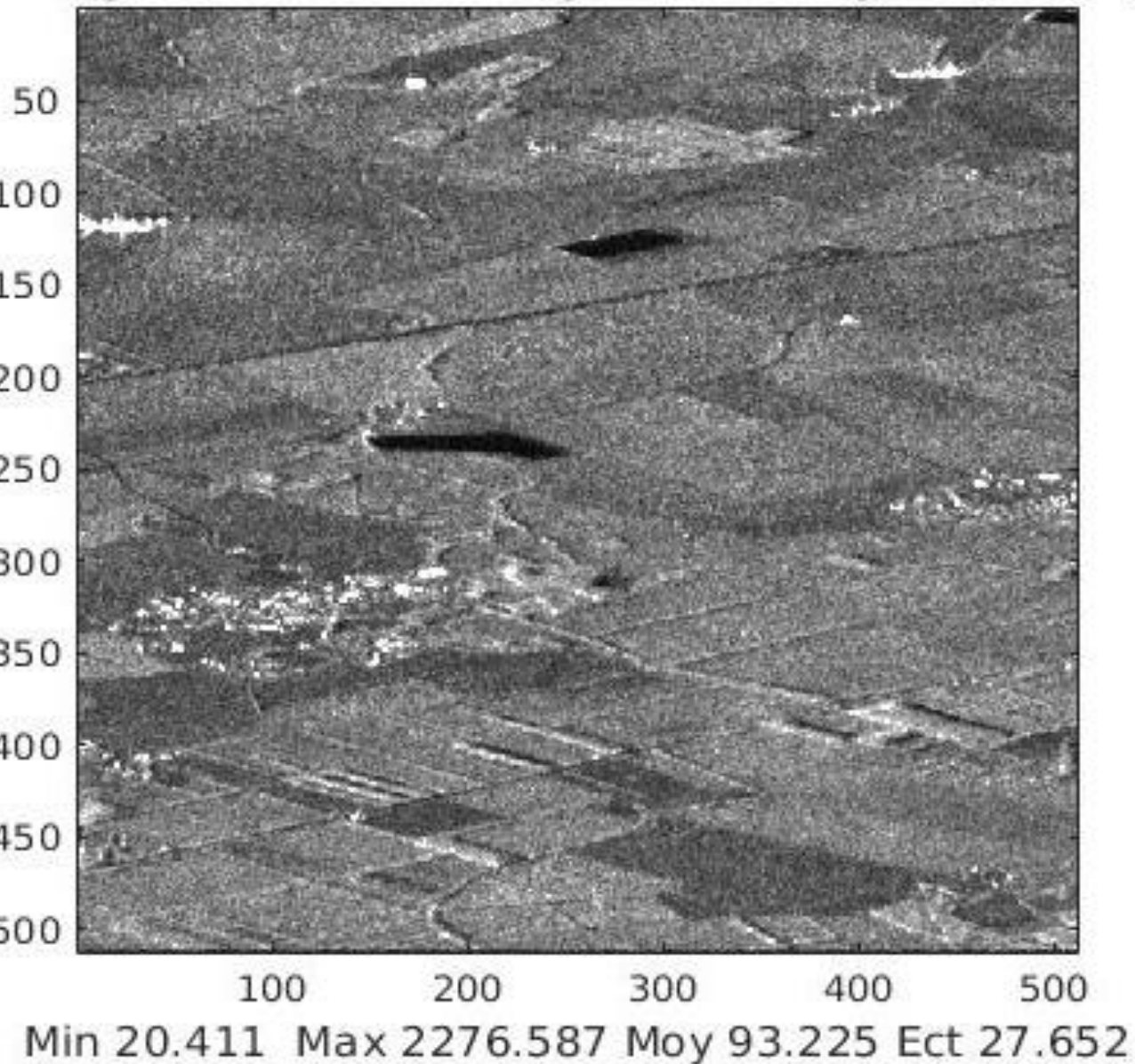
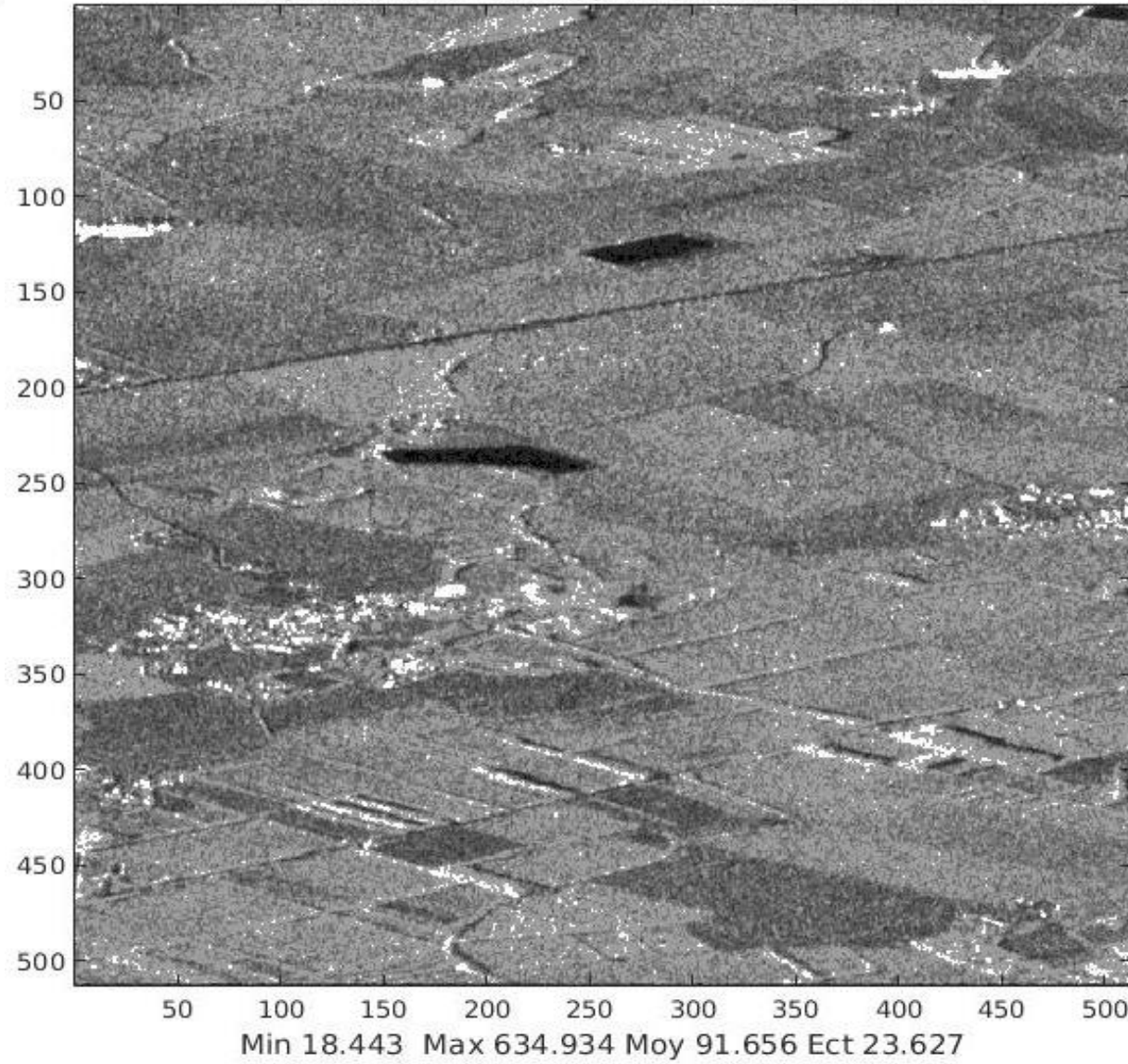


Image seuillee : valmoy + 3.000 sigma (162.5)



K=20

# SLIC



m=30, 225 superpixels

## SIMPLIFICATIONS:

- Initialisation: centres des superpixels dans une grille rectangulaire, plutôt qu'une grille hexagonale
- Initialisation: pas déplacé les centres de superpixels dans le minimum du gradient dans un voisinage 3x3
- Pas de post-processing
- Distance:

$$D = \sqrt{d_c^2 + \left(\frac{d_s}{S}\right)^2 m^2}.$$

plutôt que:

$$D' = \sqrt{\left(\frac{d_c}{N_c}\right)^2 + \left(\frac{d_s}{N_s}\right)^2}$$

Source: <https://infoscience.epfl.ch/record/177415>



**Image seuillee : valmoy + 3.000 sigma (162.2)**

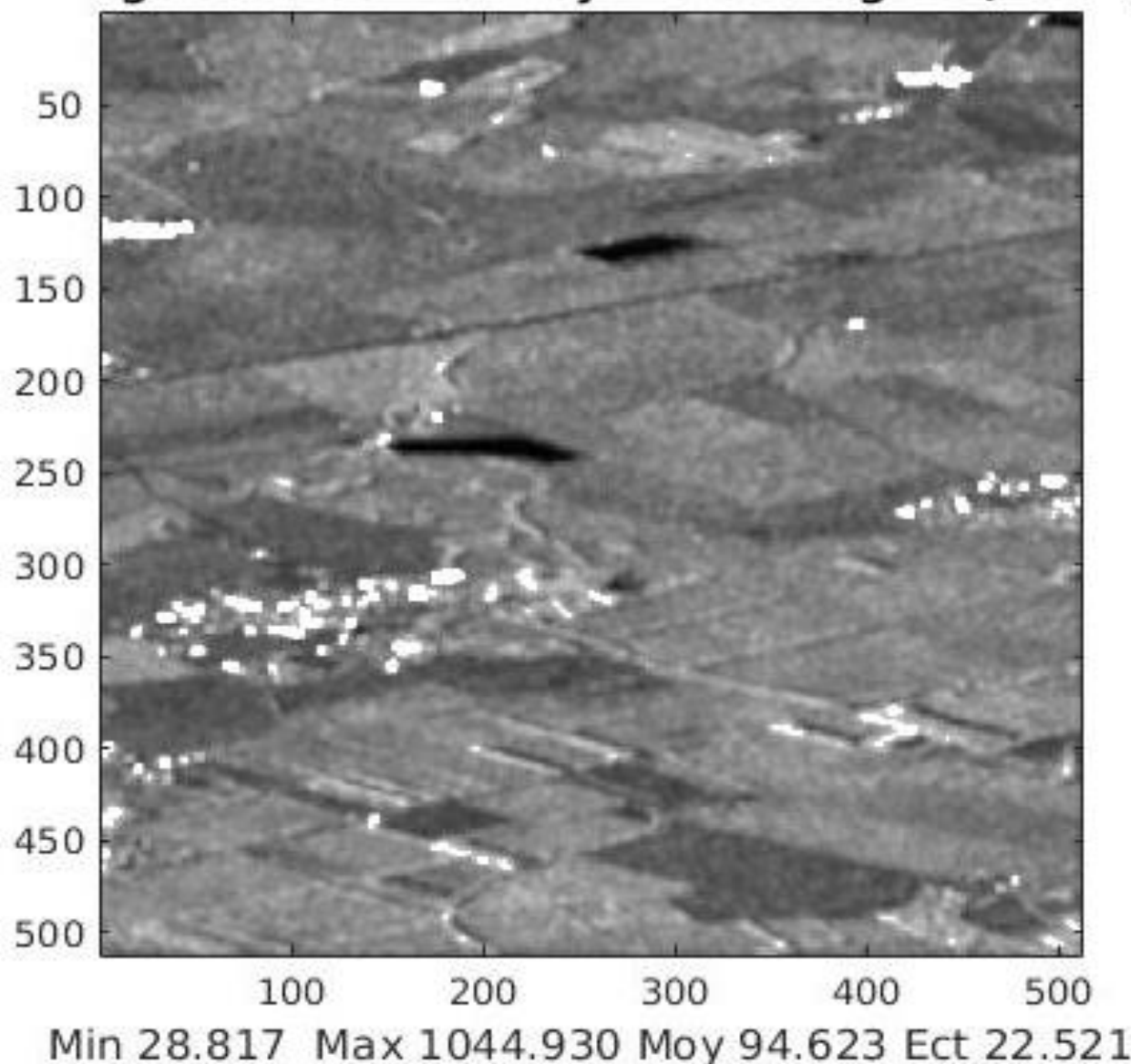
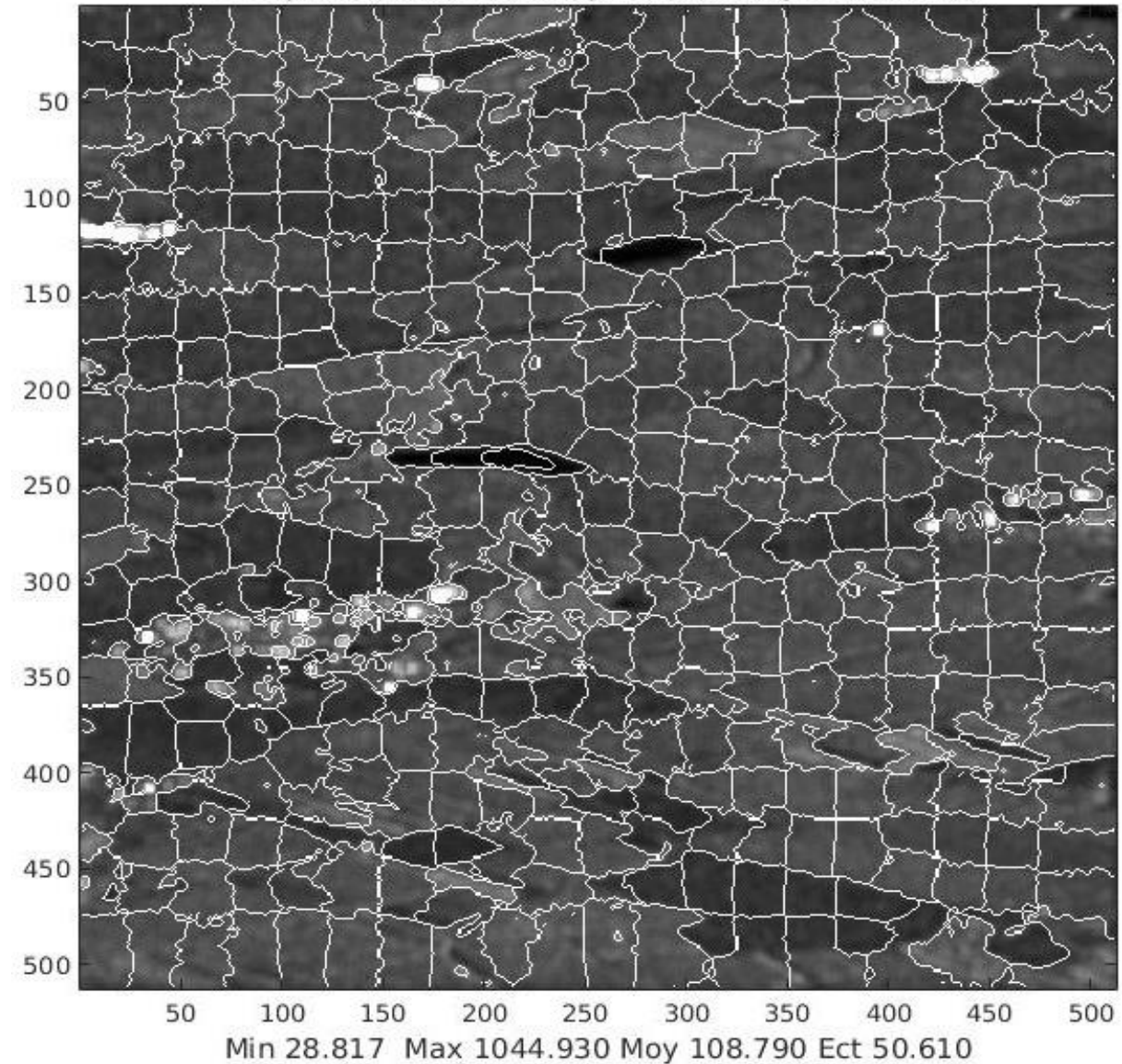


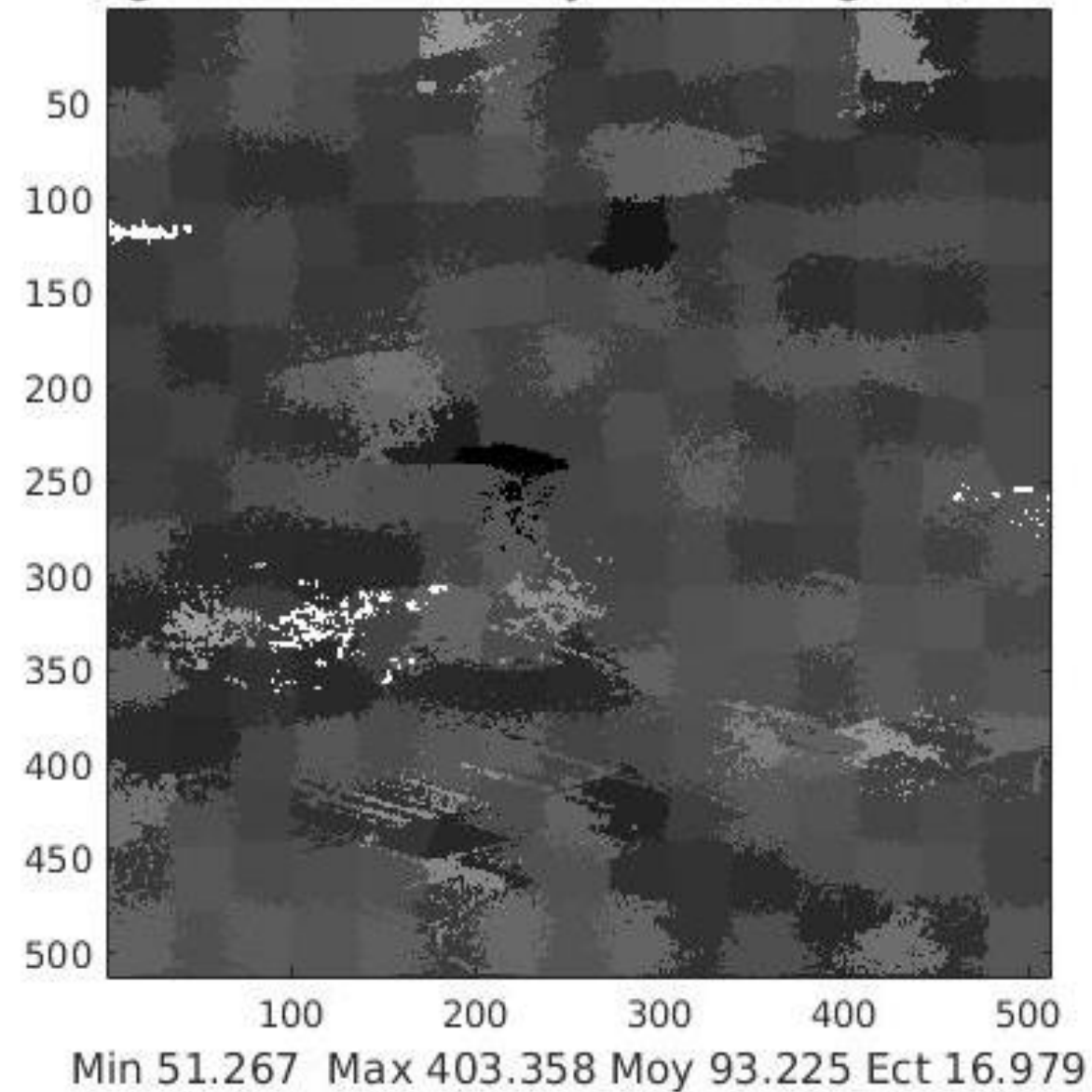
Image moyennée 5x5

**Image seuillee : valmoy + 3.000 sigma (260.6)**



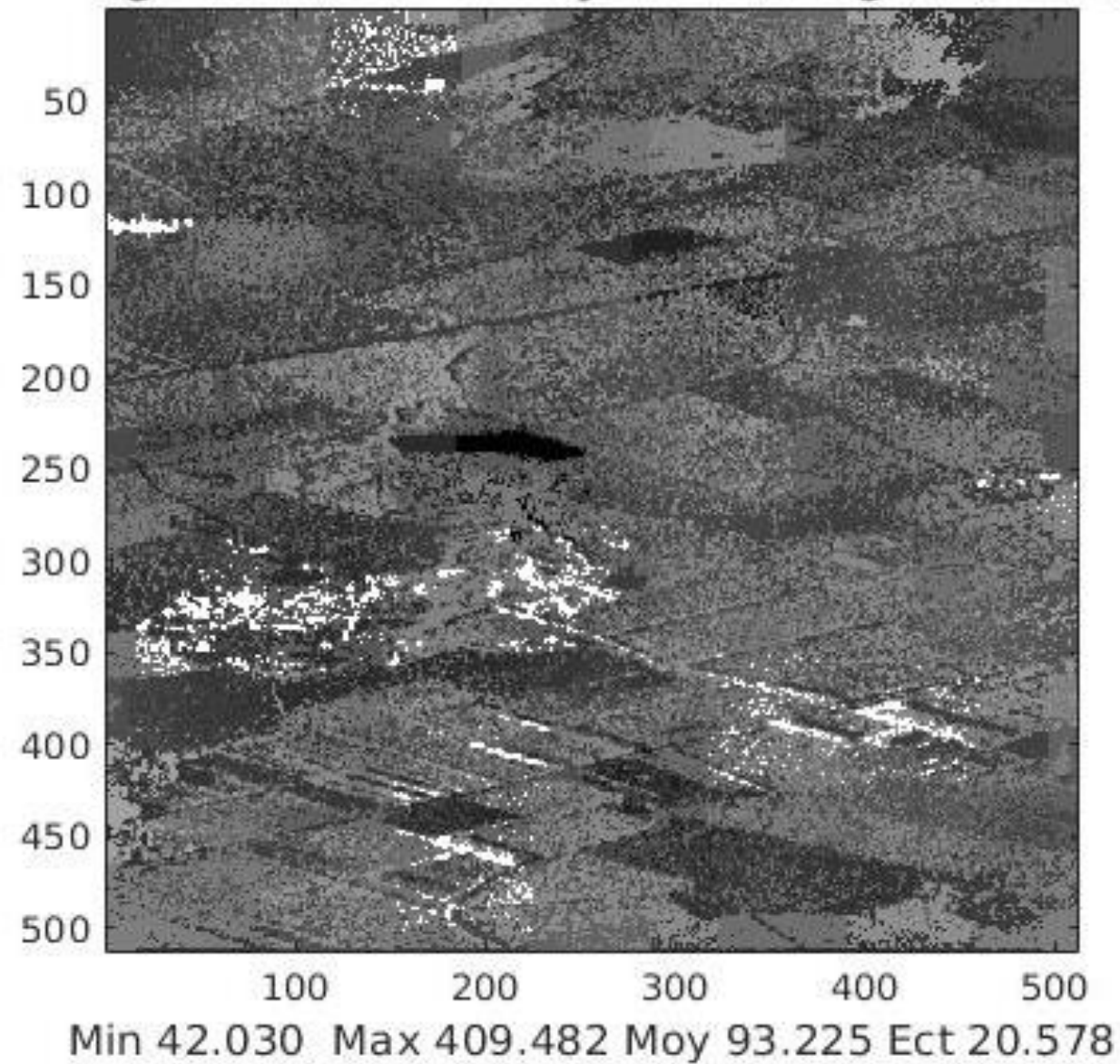
m=20, 400 superpixels

**Image seuillee : valmoy + 6.000 sigma (195.1)**



m=40, 225 superpixels

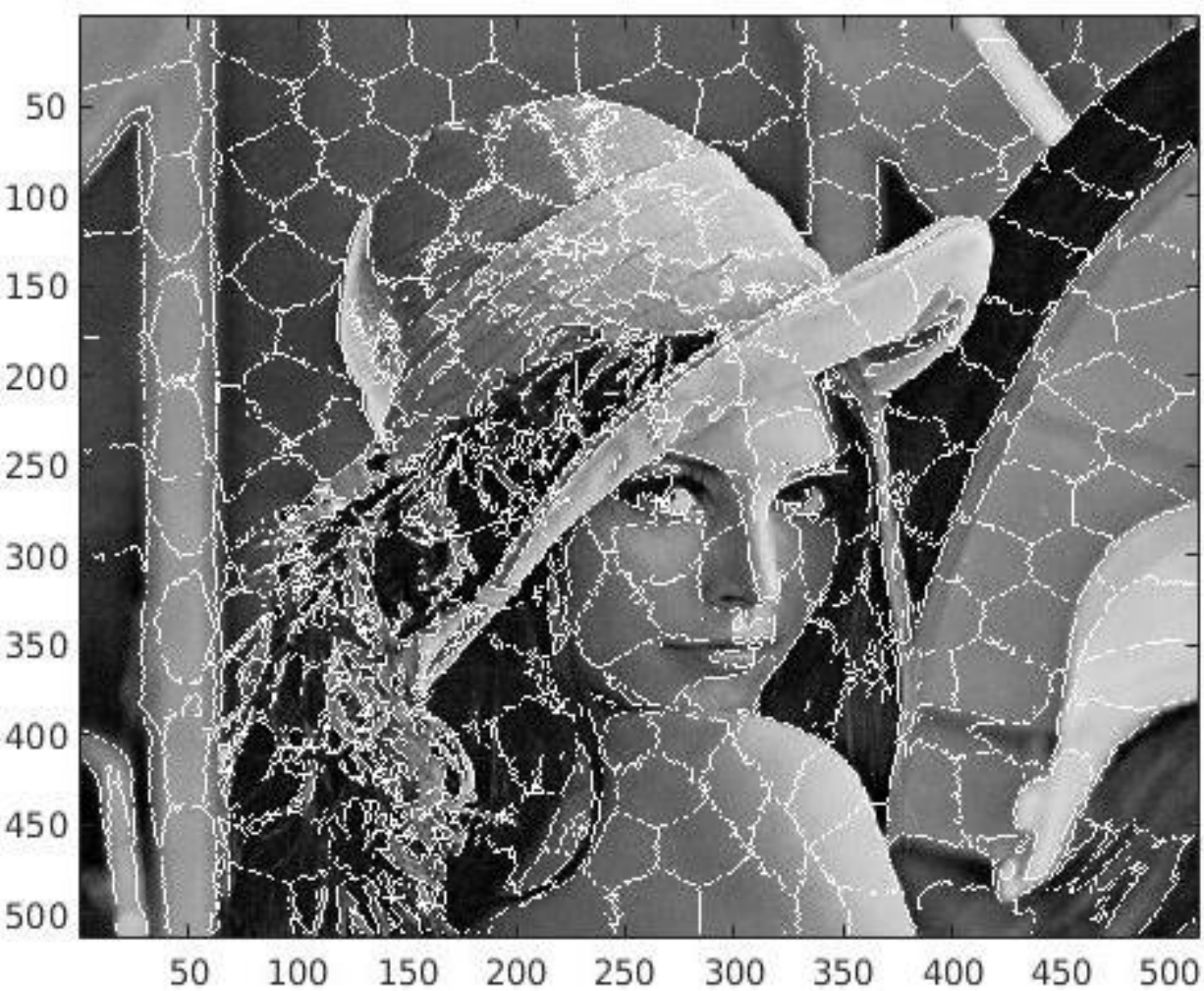
**Image seuillee : valmoy + 4.000 sigma (175.5)**



m=10, 225 superpixels



# RESULTATS EXPERIMENTAUX



$m=30$ , 200 superpixels

Nous avons utilisé le code de SLIC de Peter Kovesi, qu'on peut trouver sur ce lien :

<http://www.peterkovesi.com/projects/segmentation/>

Nous l'avons adapté pour pouvoir l'utiliser avec des images en niveaux de gris.

**Image seuillée : valmoy + 3.000 sigma (176.2)**

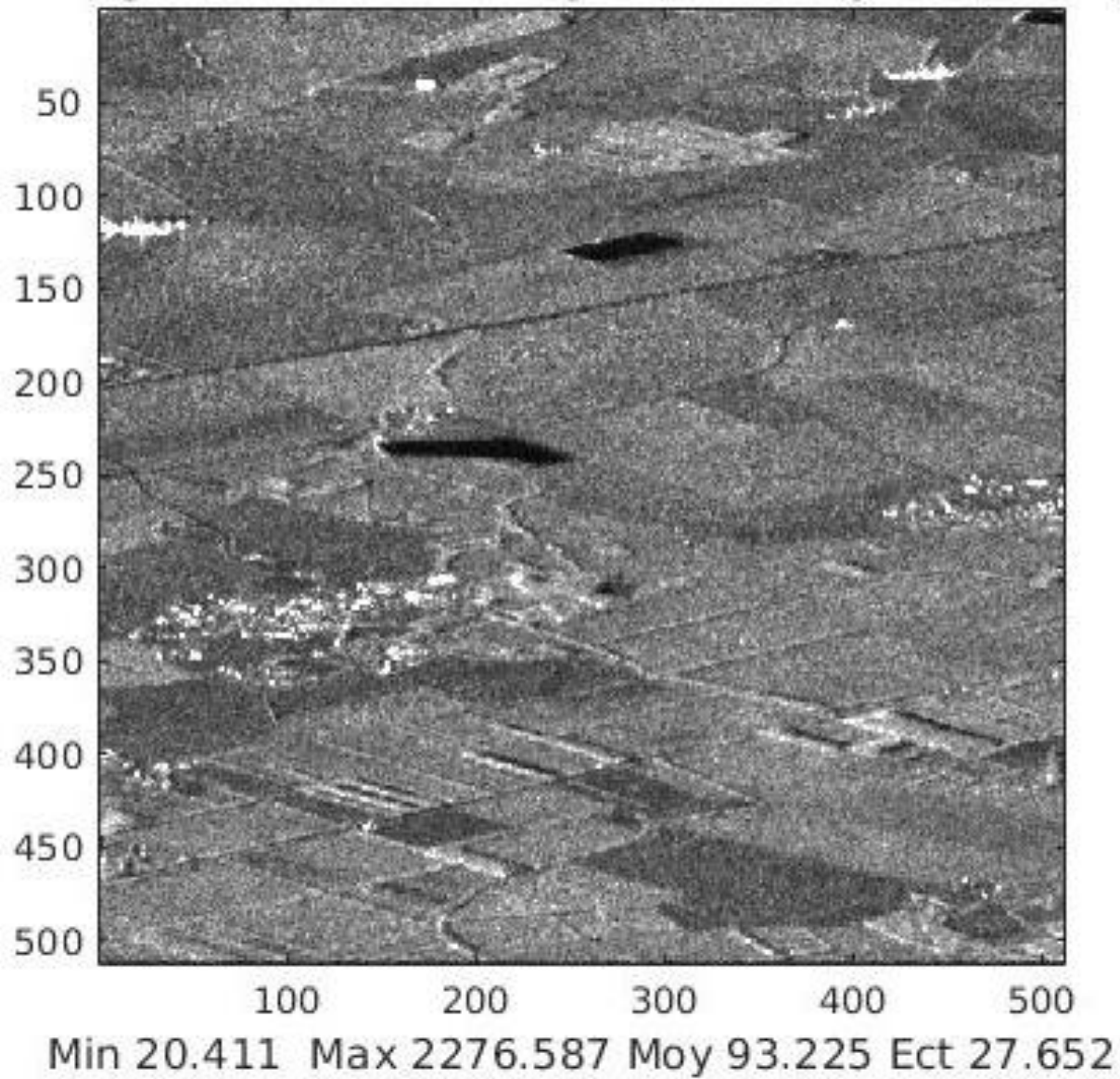
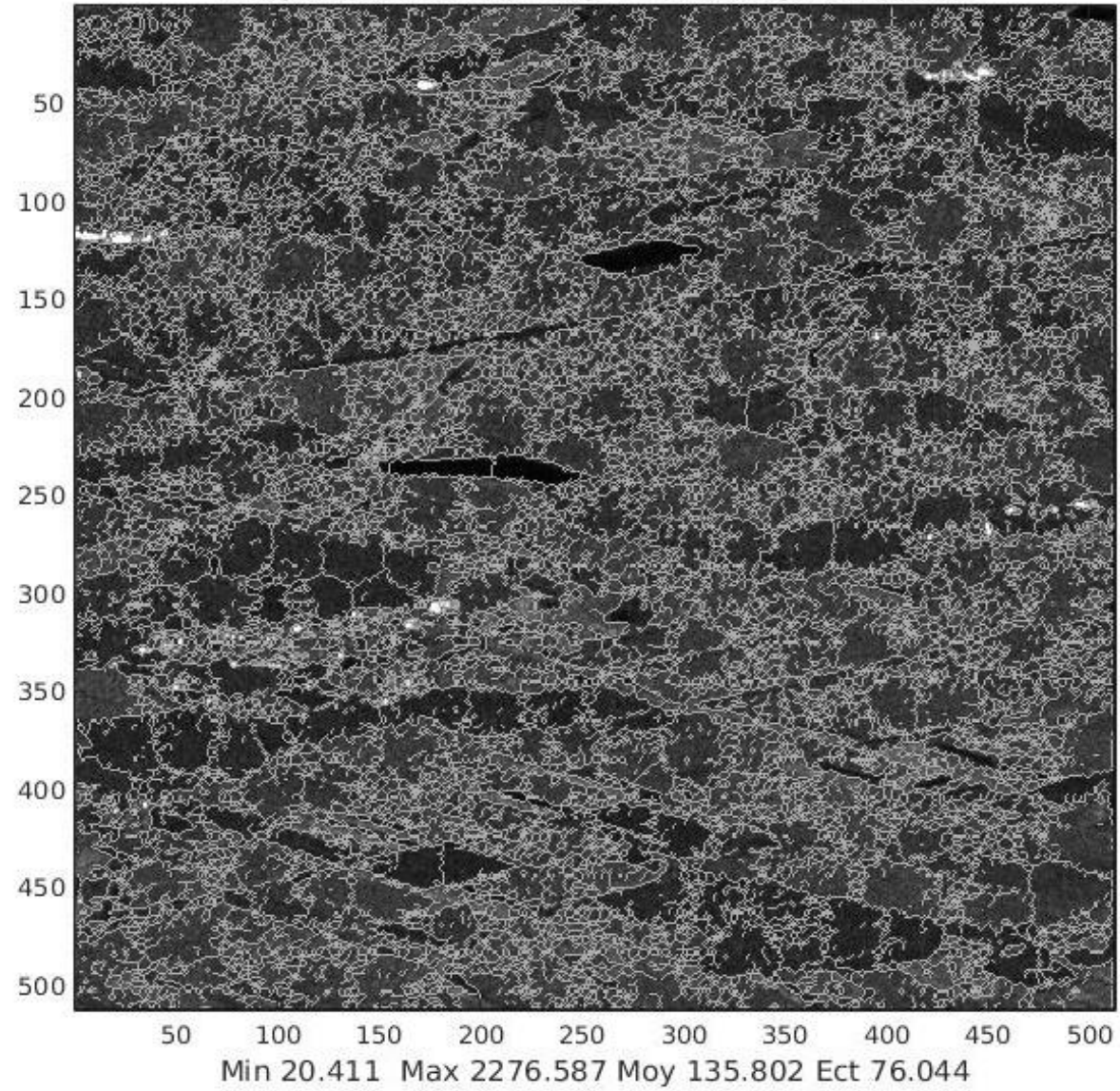


Image non filtrée

**Image seuillée : valmoy + 3.000 sigma (363.9)**



m=20, 400 superpixels



**Image seuillée : valmoy + 3.000 sigma (167.0)**

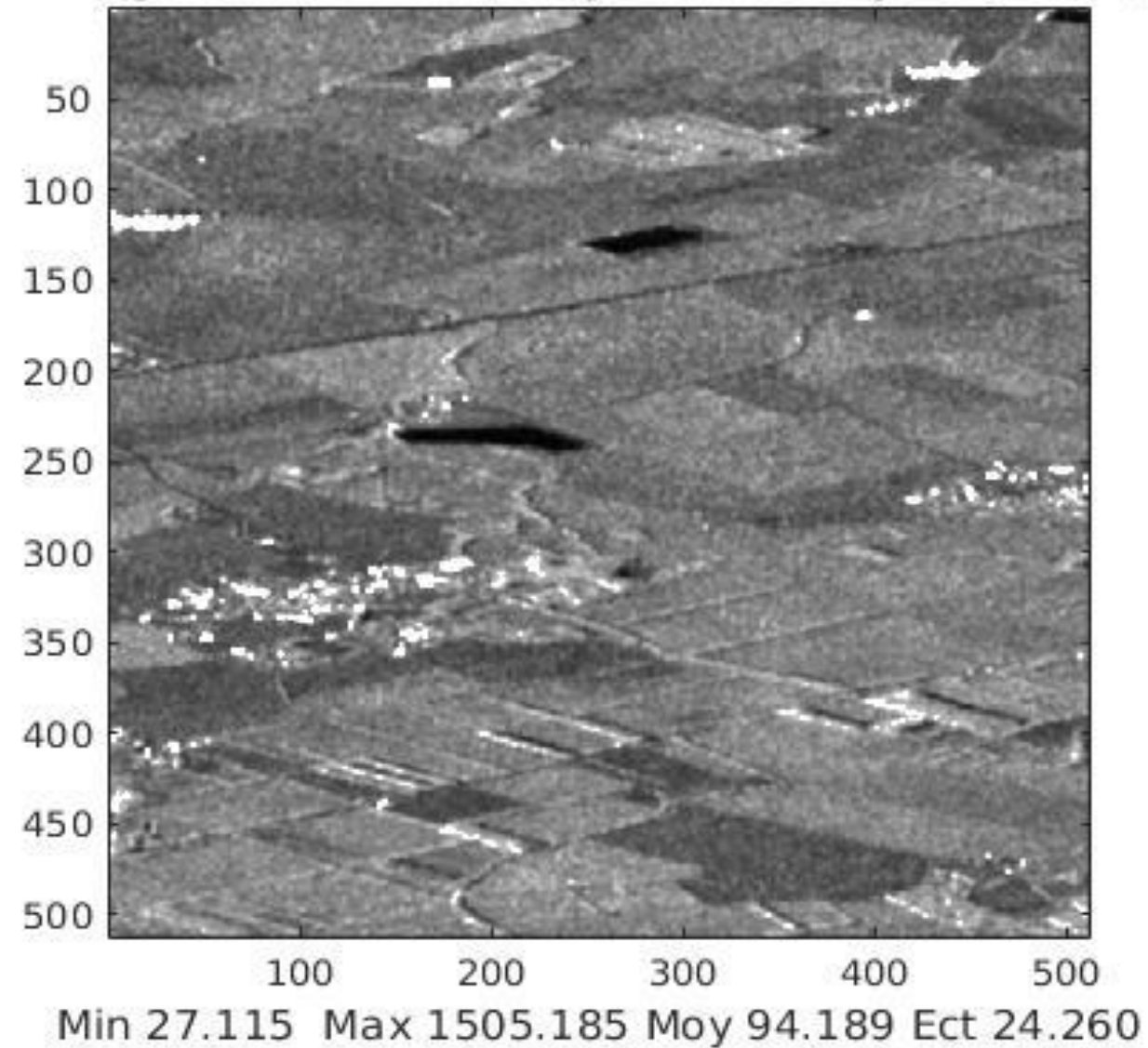
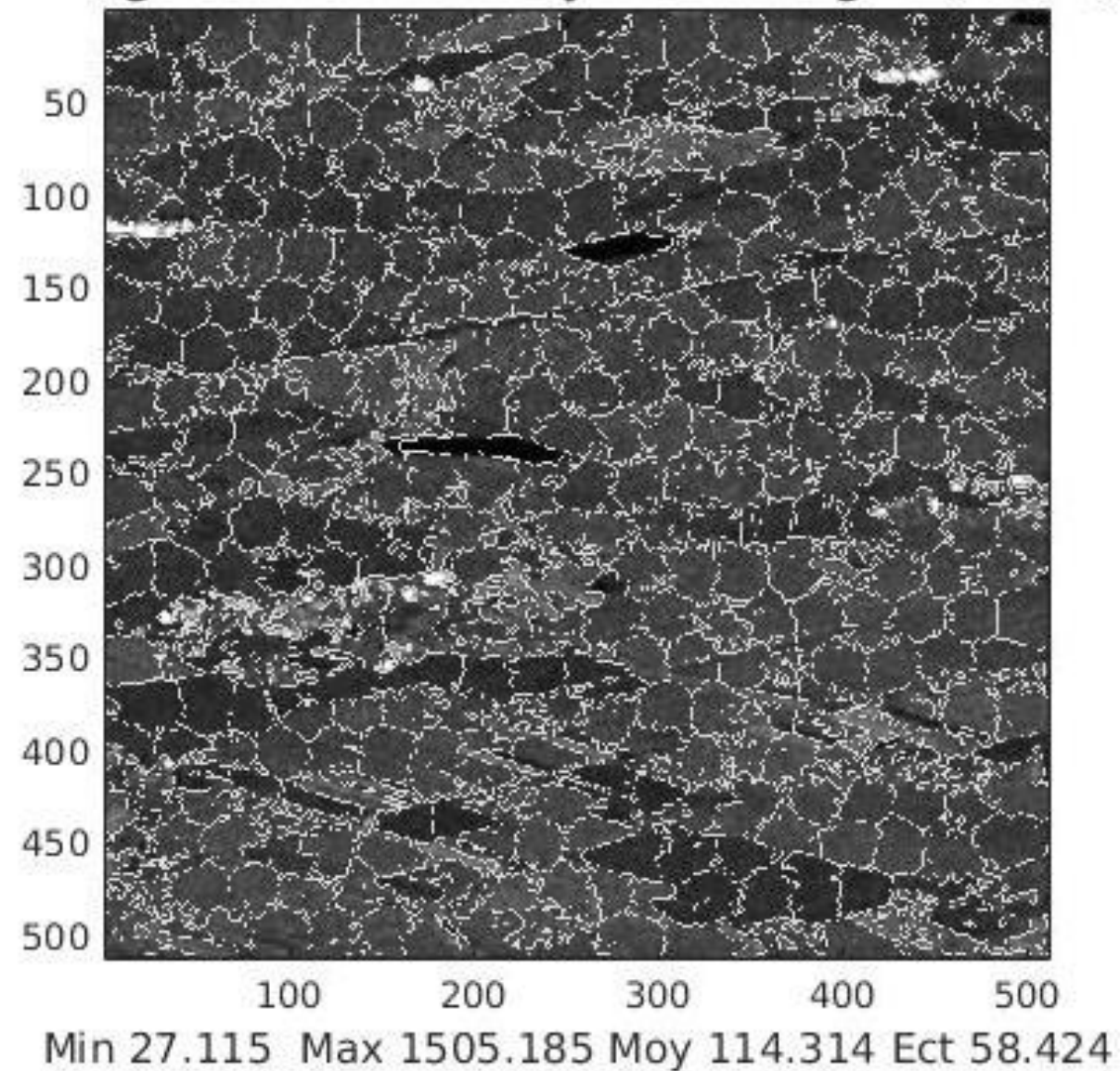


Image moyennée 3x3

**Image seuillée : valmoy + 3.000 sigma (289.6)**



m=20, 400 superpixels

**Image seuilée : valmoy + 3.000 sigma (162.2)**

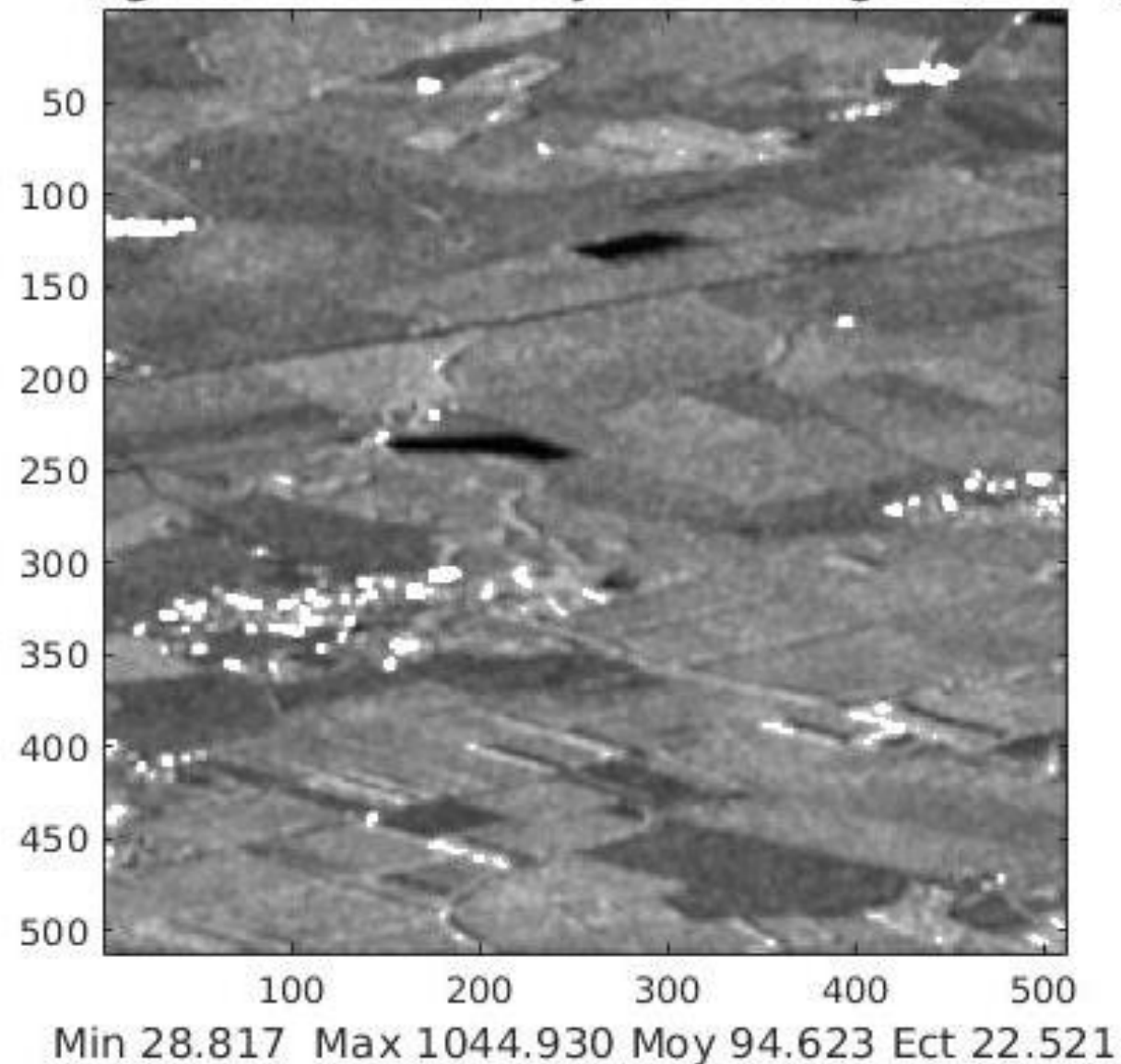
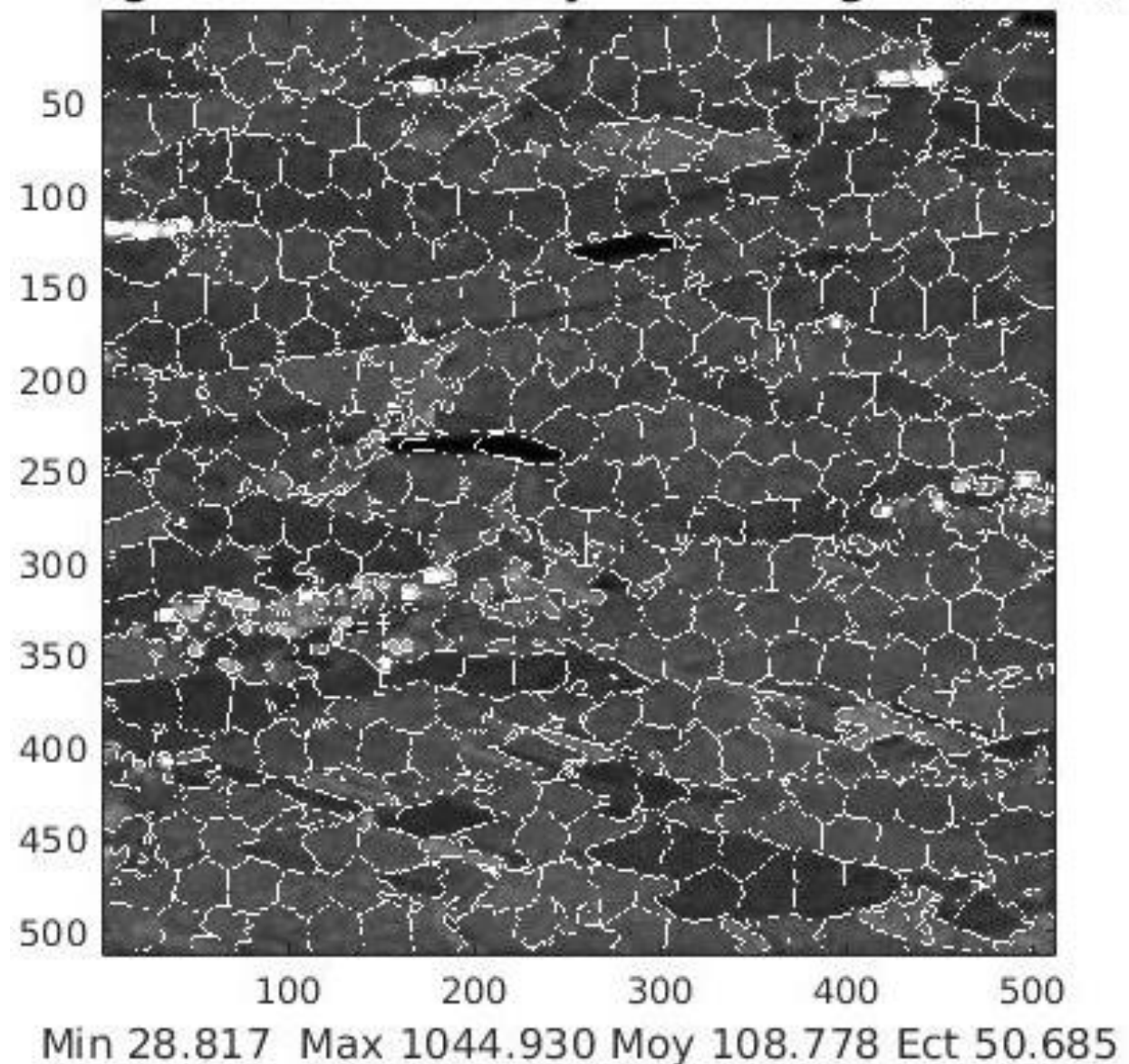


Image moyennée 5x5

**Image seuilée : valmoy + 3.000 sigma (260.8)**



m=20, 400 superpixels



**Image seuilée : valmoy + 3.000 sigma (158.8)**

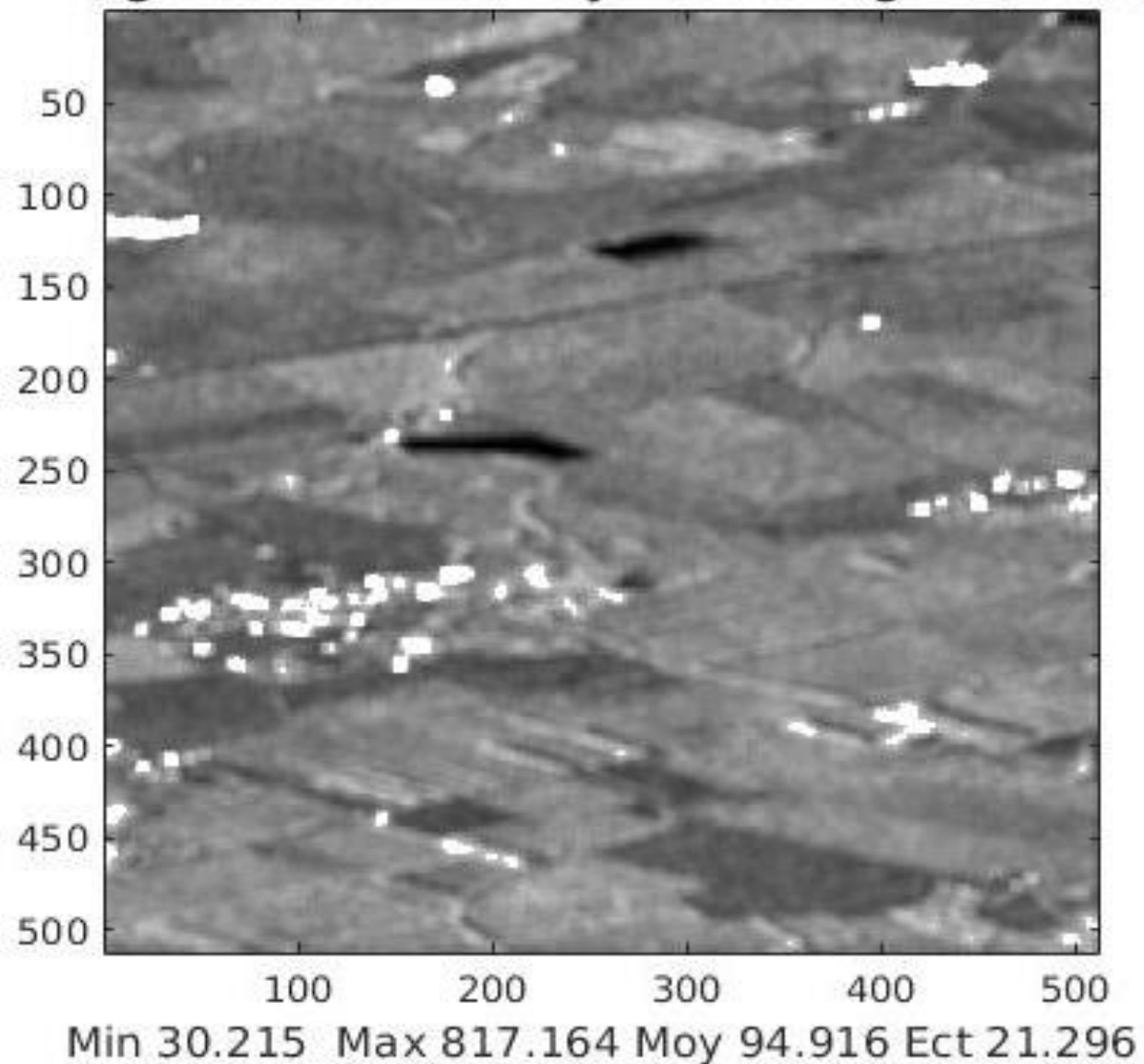
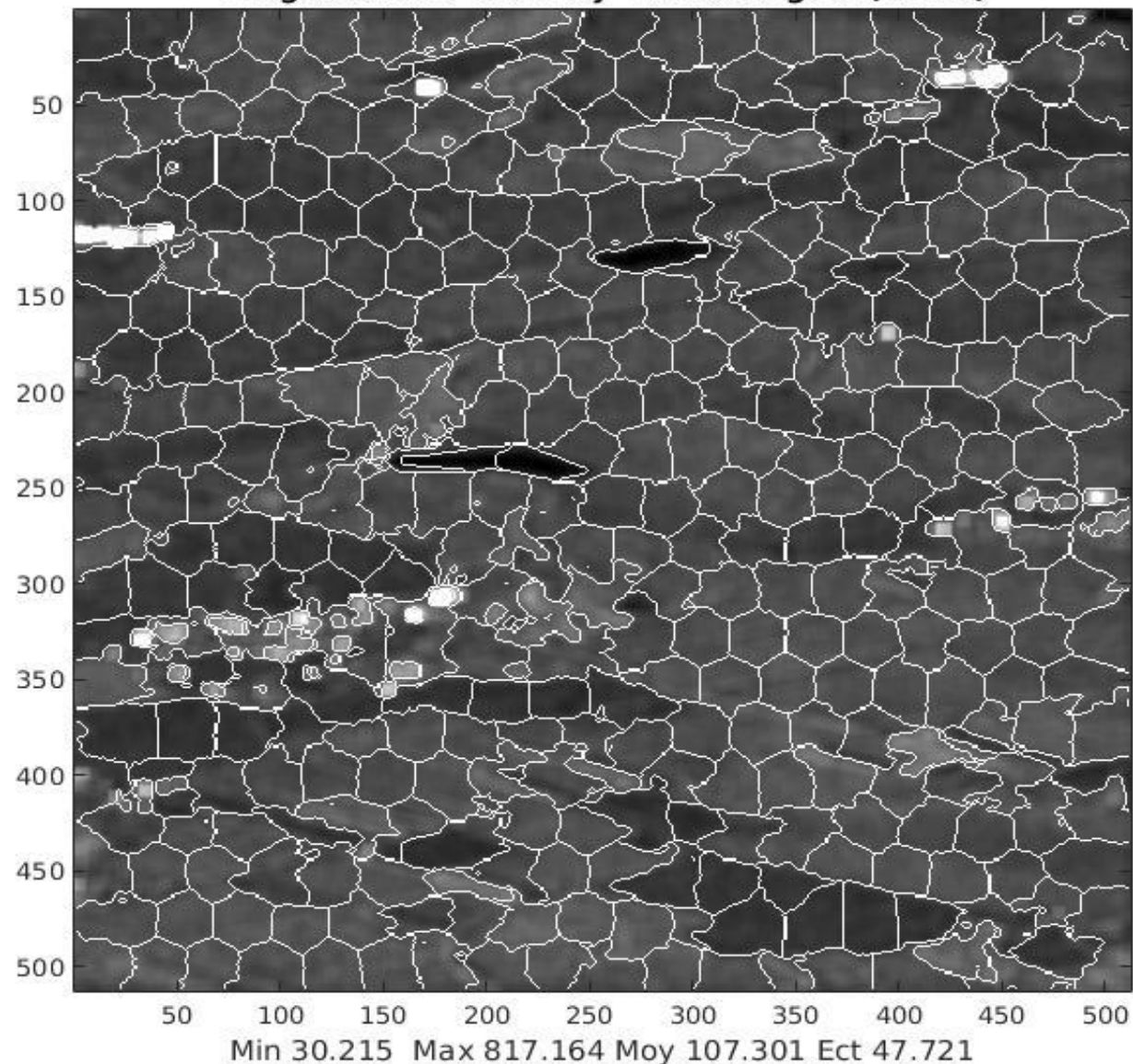


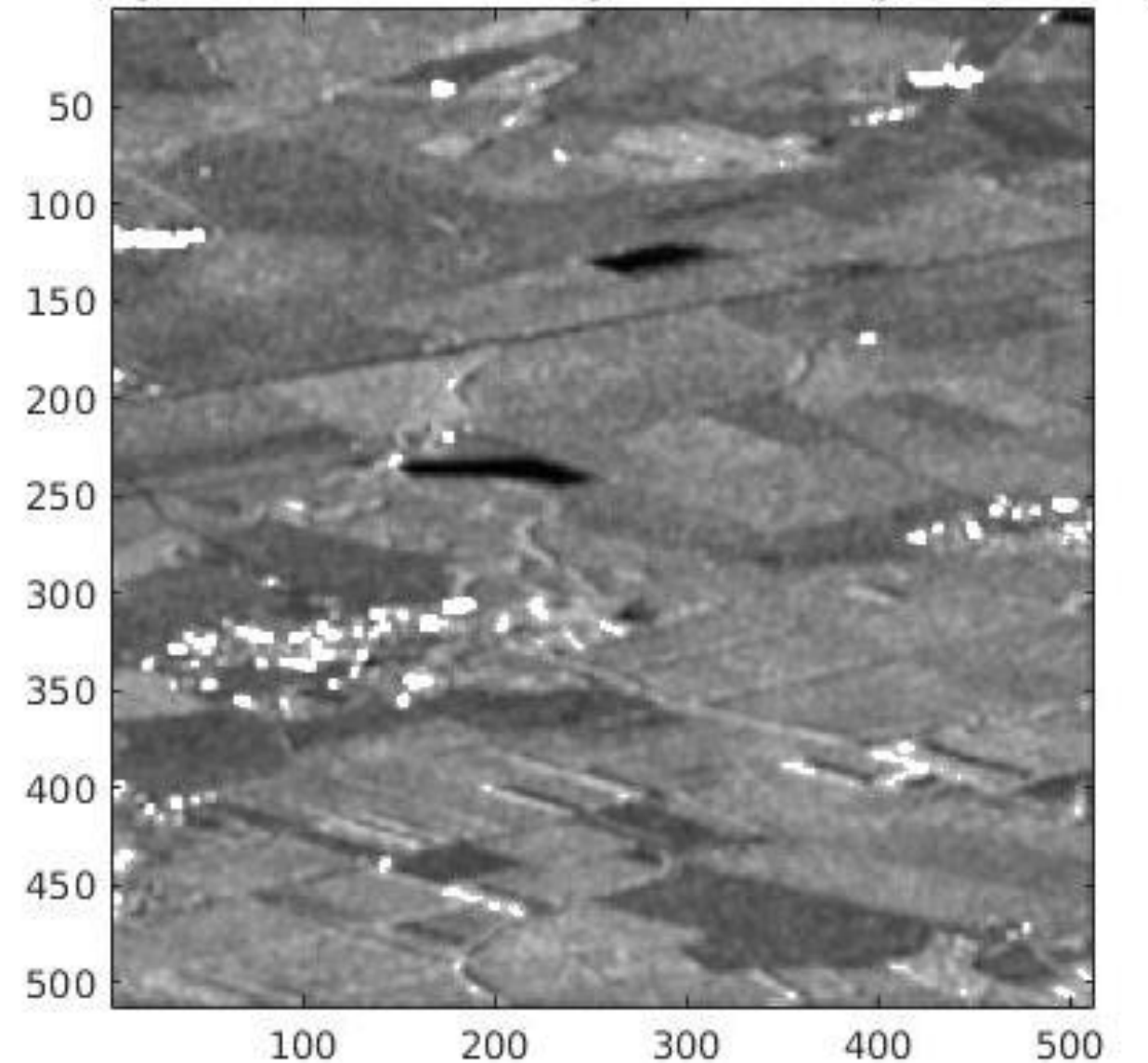
Image moyennée 7x7

**Image seuilée : valmoy + 3.000 sigma (250.5)**



m=20, 400 superpixels

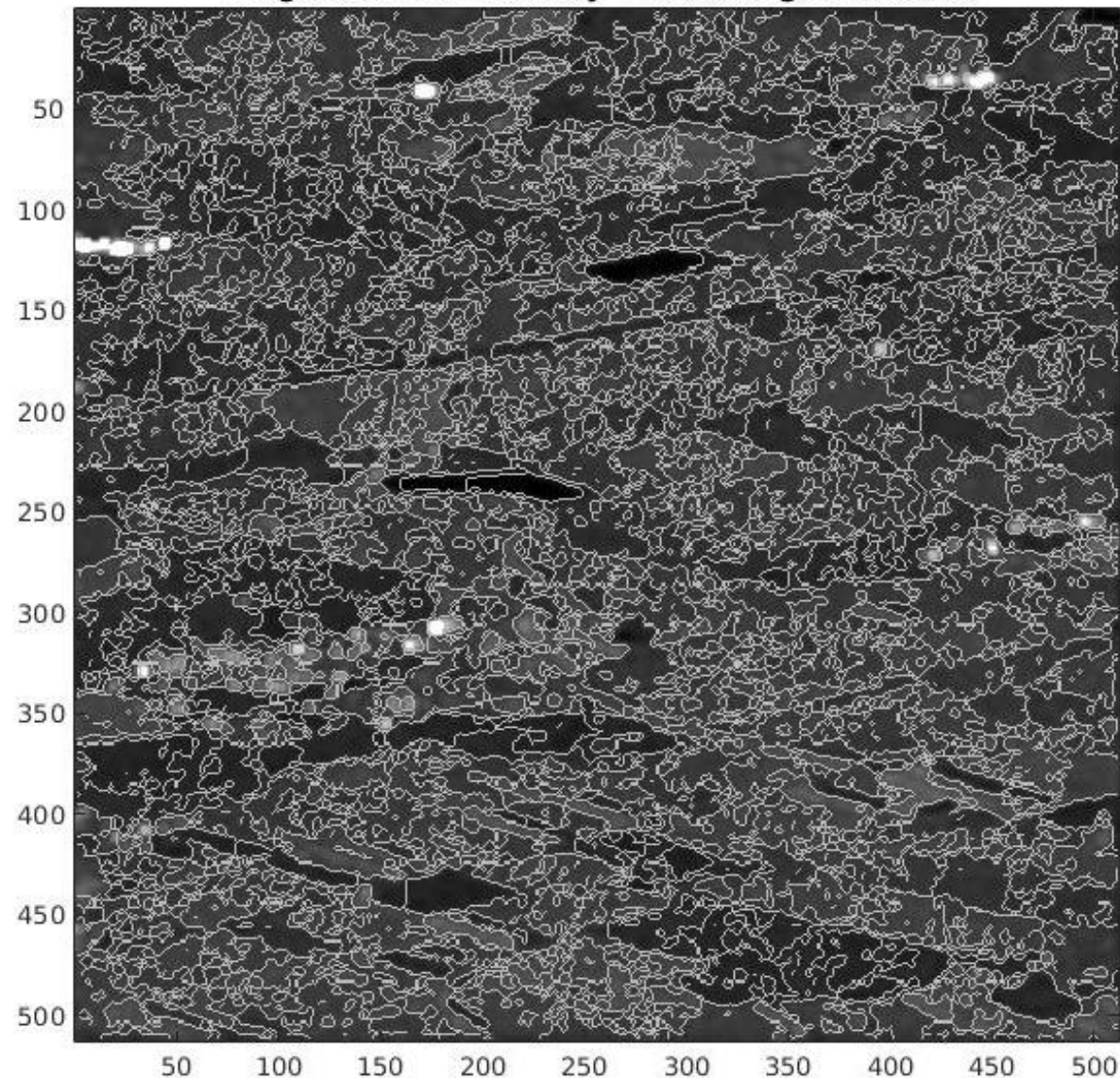
**Image seuillee : valmoy + 3.000 sigma (162.2)**



Min 28.817 Max 1044.930 Moy 94.623 Ect 22.521

Image moyennée 5x5

**Image seuillee : valmoy + 3.000 sigma (333.5)**

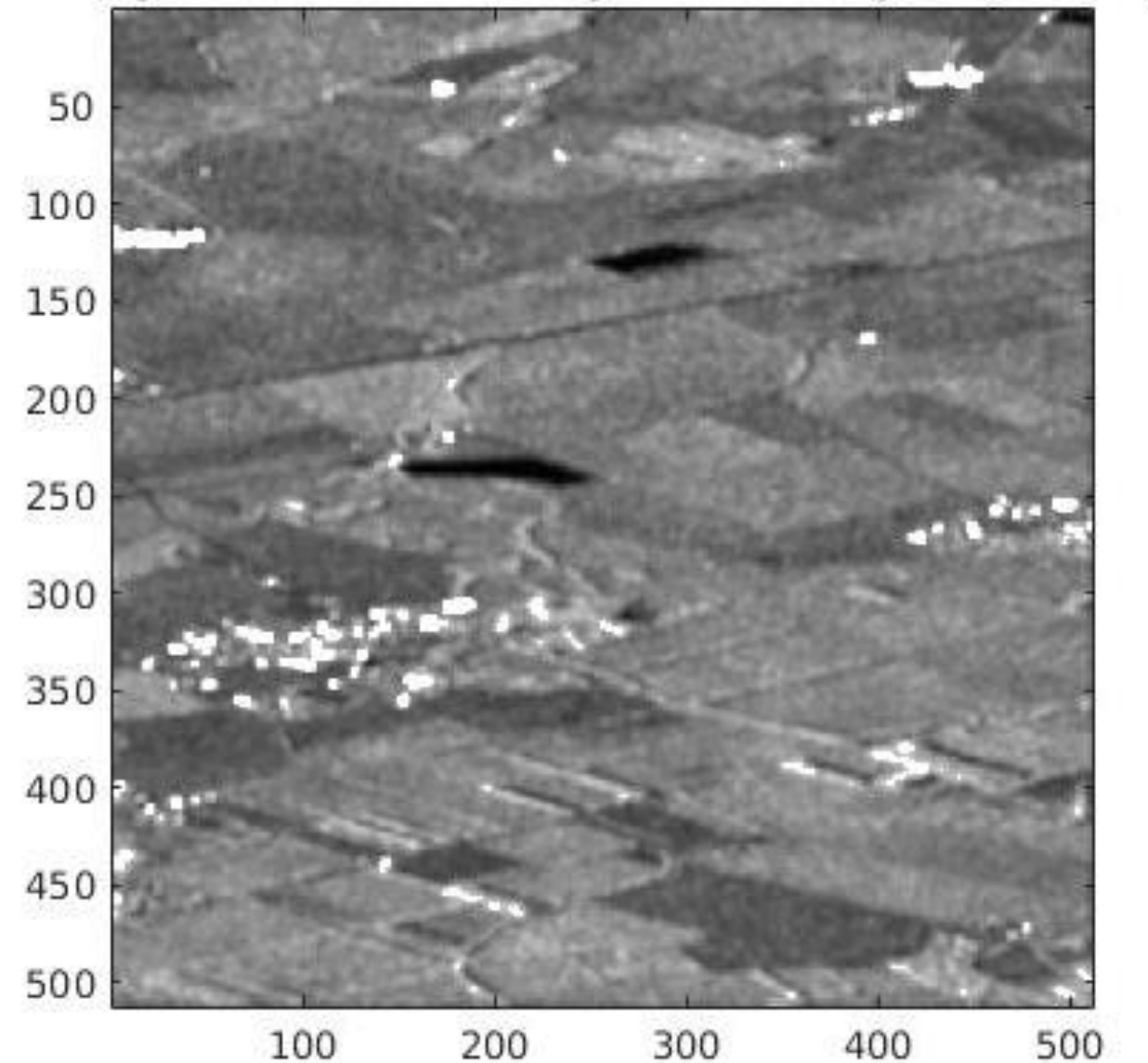


Min 28.817 Max 1044.930 Moy 127.851 Ect 68.537

m=5, 400 superpixels



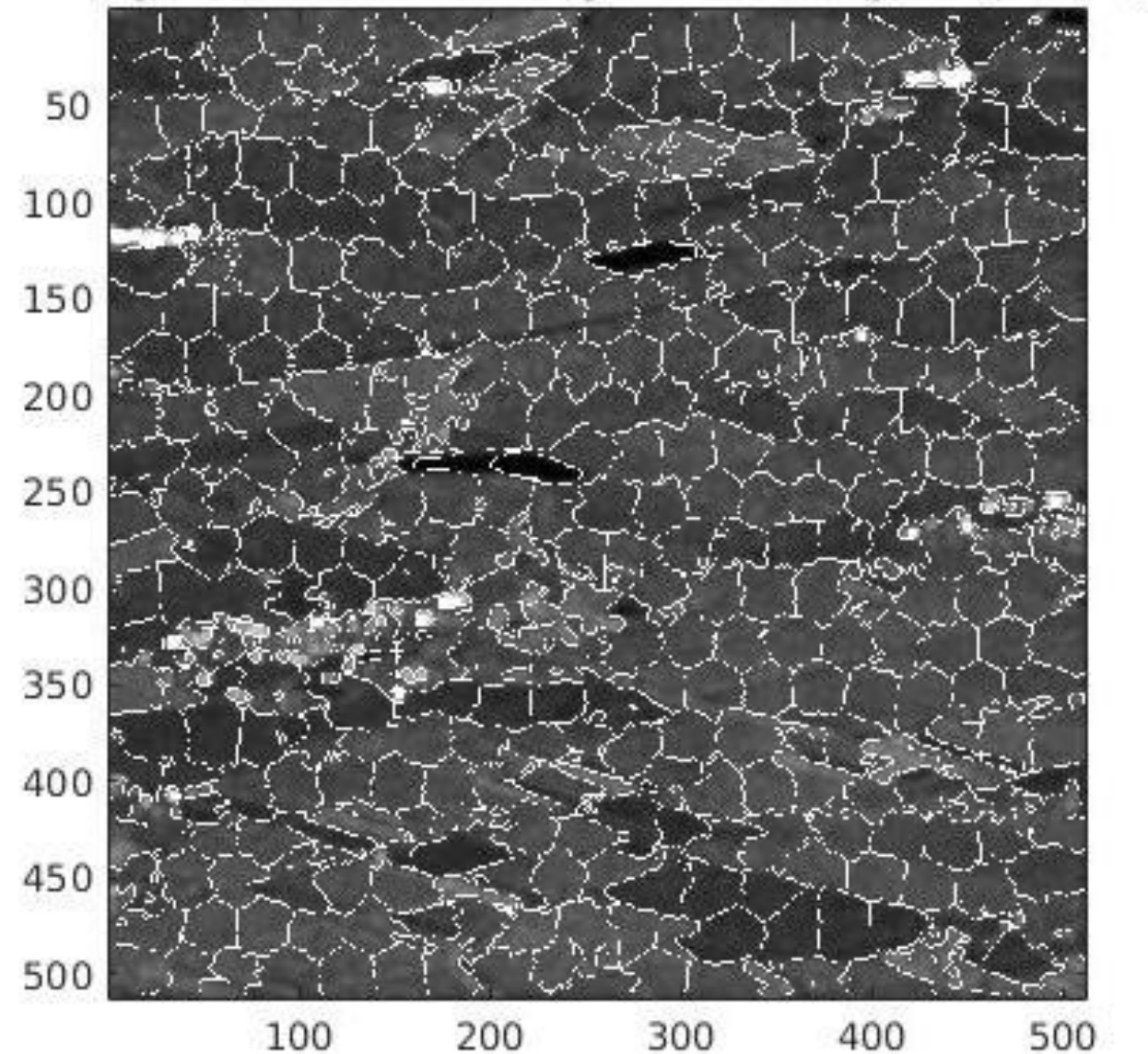
**Image seuillee : valmoy + 3.000 sigma (162.2)**



Min 28.817 Max 1044.930 Moy 94.623 Ect 22.521

Image moyennée 5x5

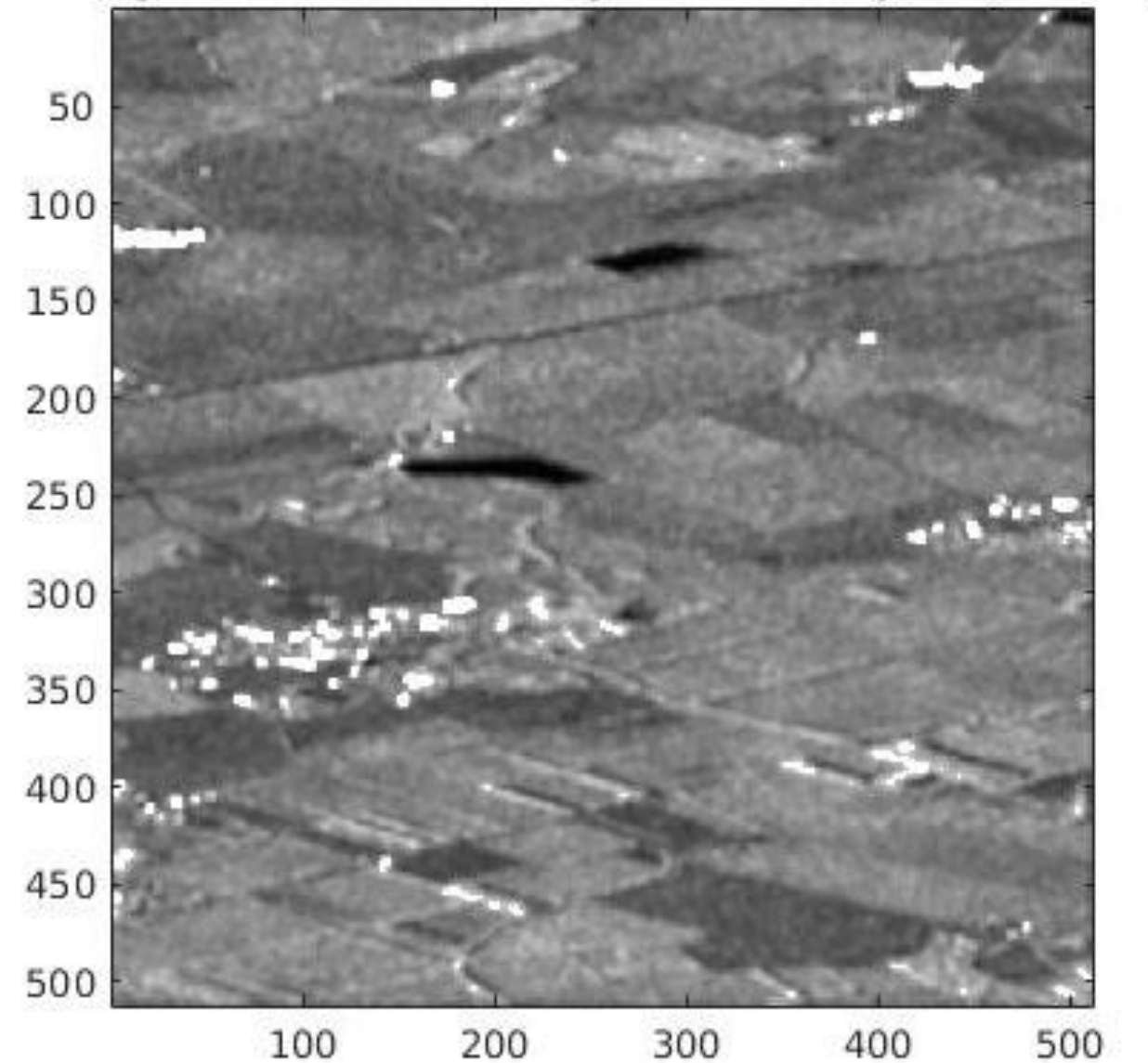
**Image seuillee : valmoy + 3.000 sigma (260.8)**



Min 28.817 Max 1044.930 Moy 108.778 Ect 50.685

m=20, 400 superpixels

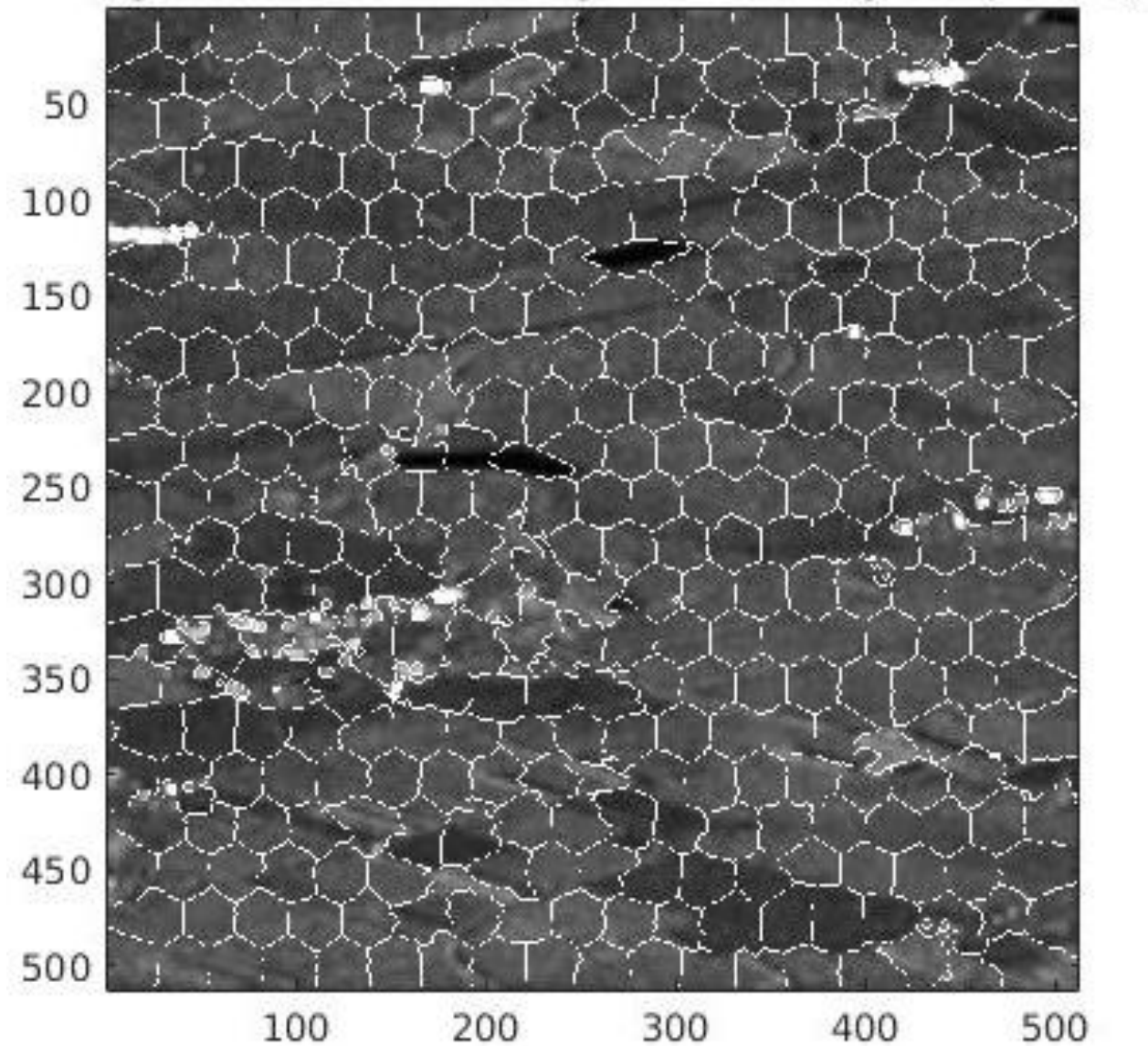
**Image seuillee : valmoy + 3.000 sigma (162.2)**



Min 28.817 Max 1044.930 Moy 94.623 Ect 22.521

Image moyennée 5x5

**Image seuillee : valmoy + 3.000 sigma (243.8)**



Min 28.817 Max 1044.930 Moy 105.520 Ect 46.104

m=40, 400 superpixels



# CONCLUSIONS

Pour avoir une bonne segmentation d'une image SAR multi-temporelle il faut:

- Filtrer l'image pour réduire le bruit
- Choisir un bon compromis entre régularité des superpixels et adhésion aux contours en choisissant le paramètre  $m$ .