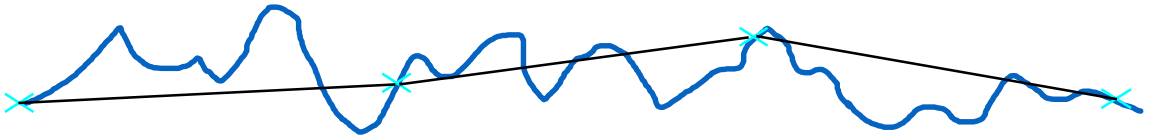
Analyse « Length-scale »

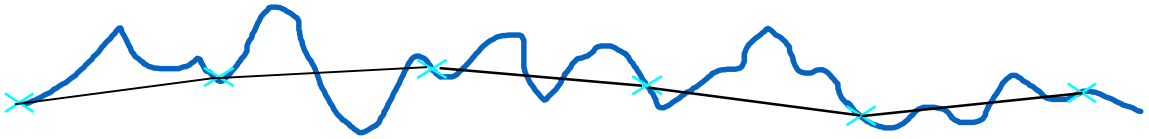
(Richardson, coastline, compass)

ASME/ANSI B46.1 2002 ch10

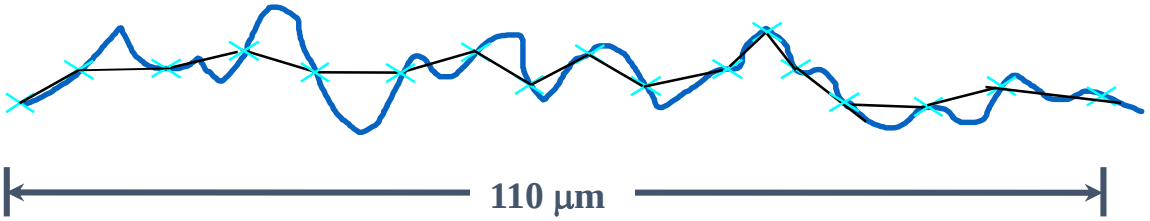
échelle = 40µm, 3 segments, longueur = 3x40 = 120µm longueur relative =1.091



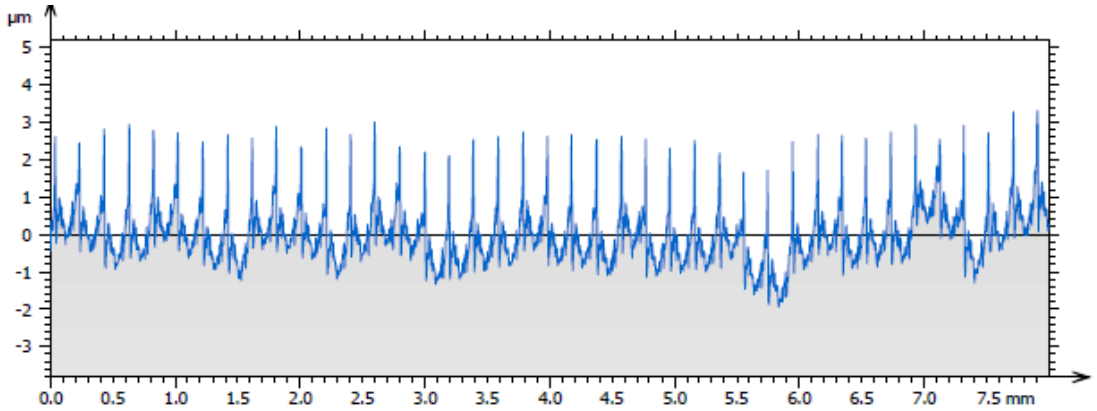
échelle = 25µm, 5 segments, longueur = 5x25 = 125µm longueur relative =1.138



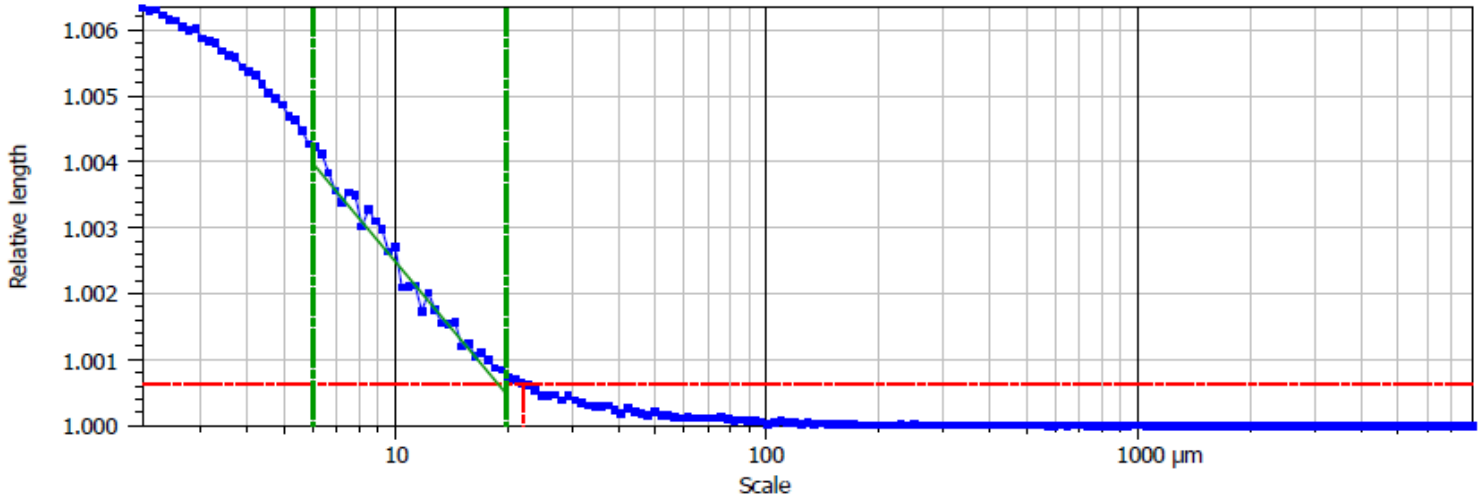
échelle = 10µm, 16 segments, longueur = 16x10 = 160µm longueur relative = 1.455



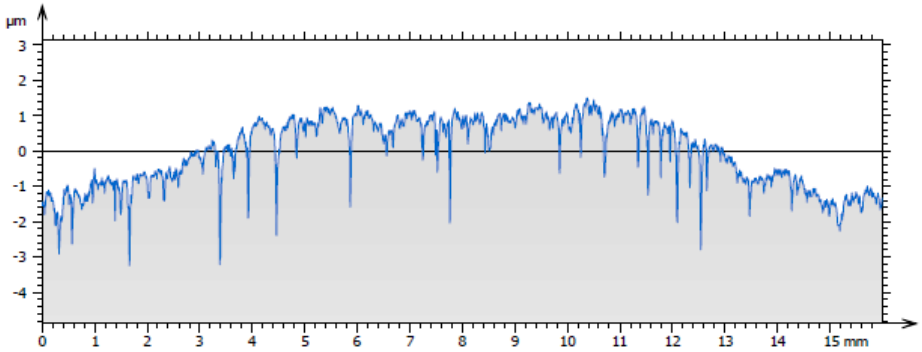
Analyse SSFA dans MountainsMap

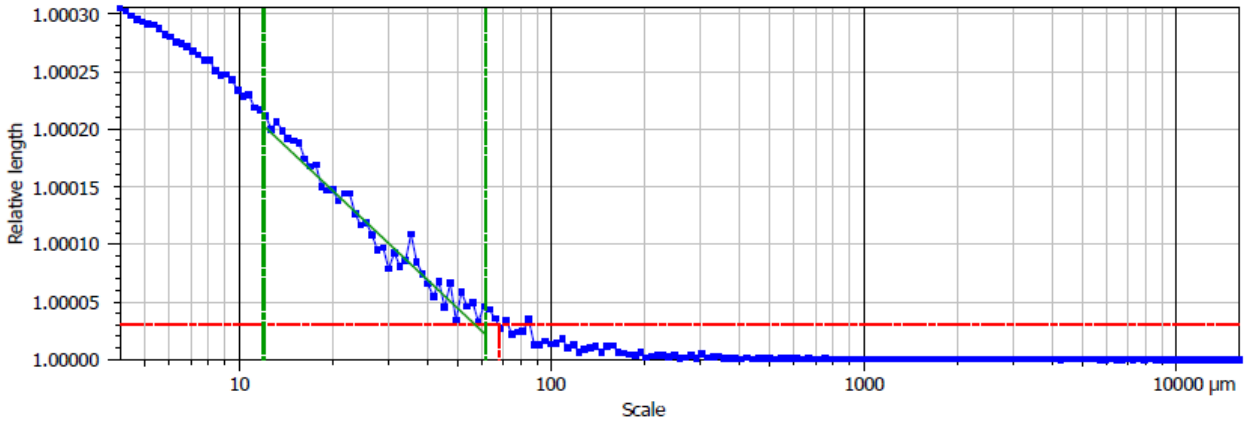


Fine turning.pro



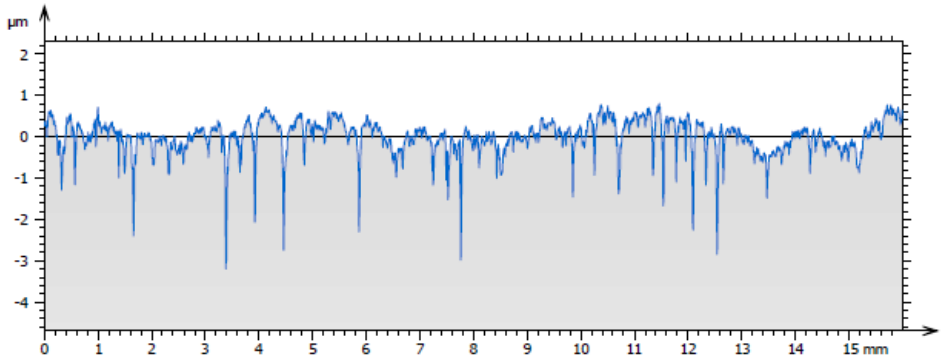
Sandpap1.pro





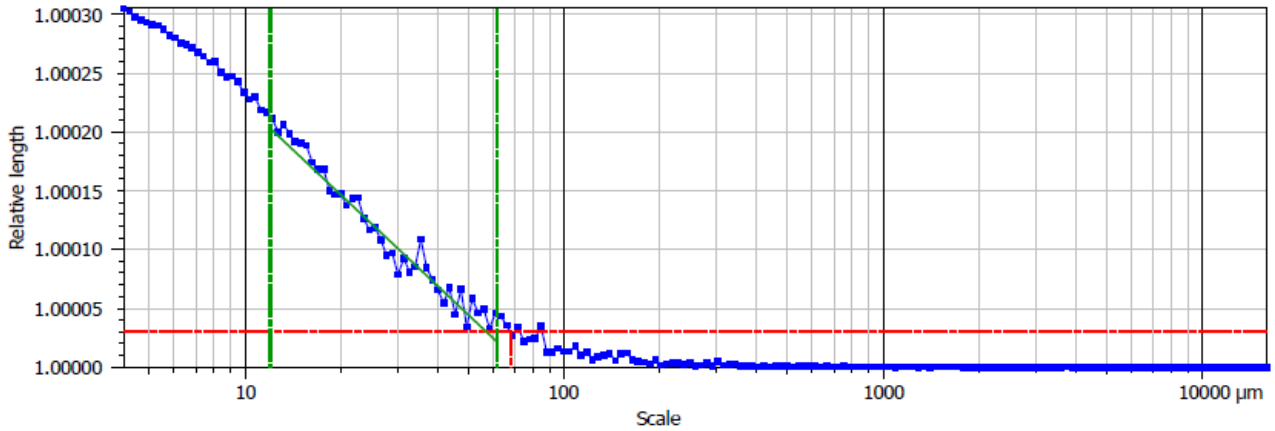
Information	
Method	Length-scale (rows)

Parameters	Value	Unit
SRC threshold	1.00003	
SRC (Smooth-rough crossover)	68.38680	µm
Reg. min scale	12.00000	µm
Reg. max scale	61.54812	µm
Reg. line slope	-0.00026	
Reg. line Y-intercept	1.00048	
Reg. coefficient R^2	*****	
Lsfc (Fractal complexity)	0.25541	
Dls (Fractal dimension)	1.00026	
Num. points	200	
Y Max	1.00031	



Sandpap1.pro

Form removed (LS poly 3)

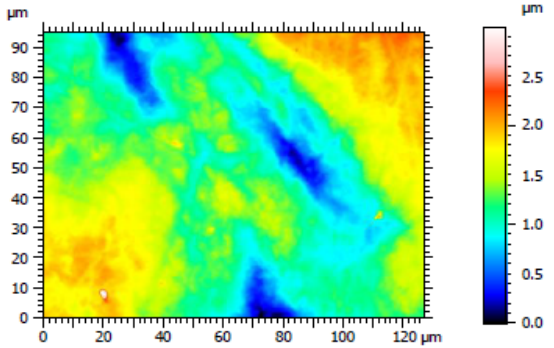


Information	
Method	Length-scale (rows)

Parameters	Value	Unit
SRC threshold	1.00003	
SRC (Smooth-rough crossover)	68.39528	µm
Reg. min scale	12.00000	µm
Reg. max scale	61.55575	µm
Reg. line slope	-0.00026	
Reg. line Y-intercept	1.00048	
Reg. coefficient R²	*****	
Lsfc (Fractal complexity)	0.25549	
Dls (Fractal dimension)	1.00026	
Num. points	200	
Y Max	1.00031	

Information	
Method	Length-scale (rows)

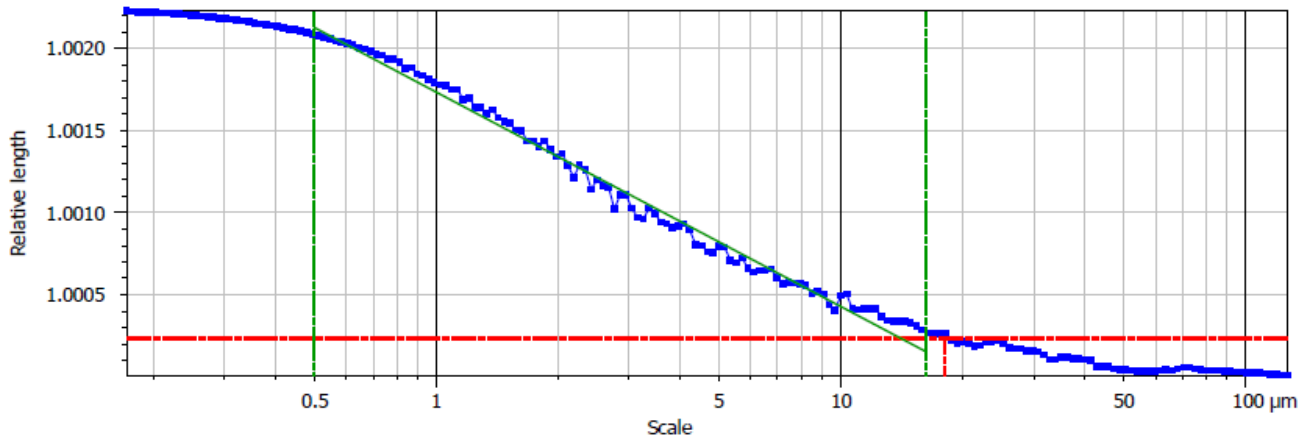
Parameters	Value	Unit
SRC threshold	1.00003	
SRC (Smooth-rough crossover)	68.38680	µm
Reg. min scale	12.00000	µm
Reg. max scale	61.54812	µm
Reg. line slope	-0.00026	
Reg. line Y-intercept	1.00048	
Reg. coefficient R²	*****	
Lsfc (Fractal complexity)	0.25541	
Dls (Fractal dimension)	1.00026	
Num. points	200	
Y Max	1.00031	



testsur1.sur

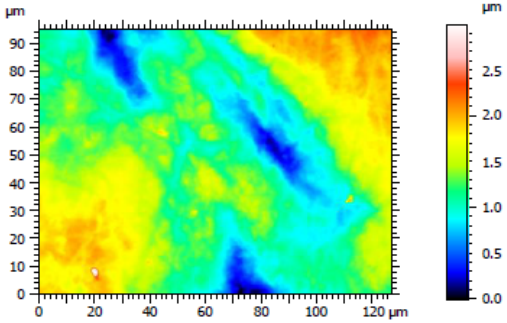
Length-scale (rows)

Full mode (all lines)



Information	
Method	Length-scale (rows)

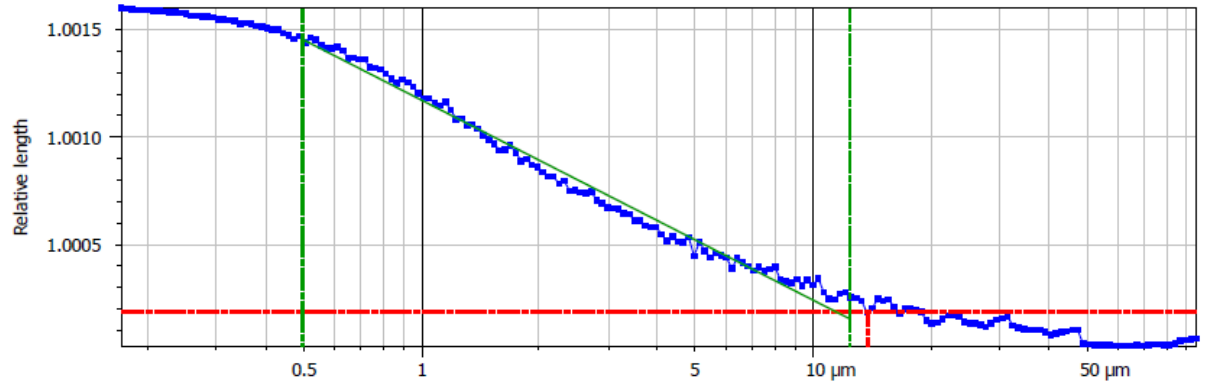
Parameters	Value	Unit
SRC threshold	1.00023	
SRC (Smooth-rough crossover)	18.02811	µm
Reg. min scale	0.49800	µm
Reg. max scale	16.22530	µm
Reg. line slope	-0.00131	
Reg. line Y-intercept	1.00173	
Reg. coefficient R^2	*****	
Asfc (Fractal complexity)	1.30611	
Das (Fractal dimension)	1.00131	
Num. points	200	
Y Max	1.00223	

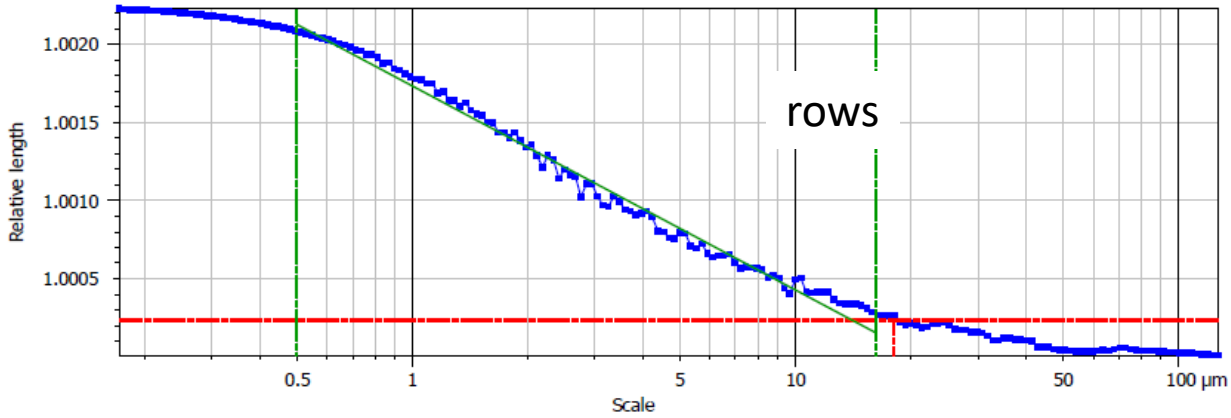


testsur1.sur

Length-scale (columns)

Draft mode

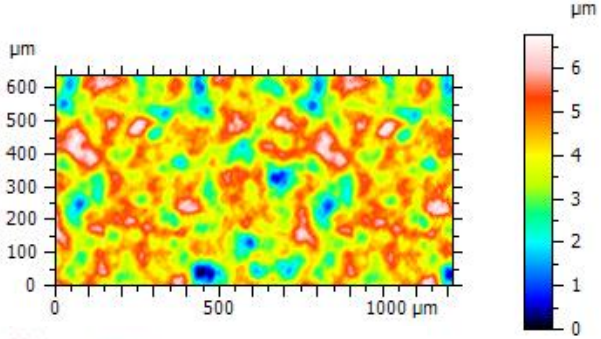


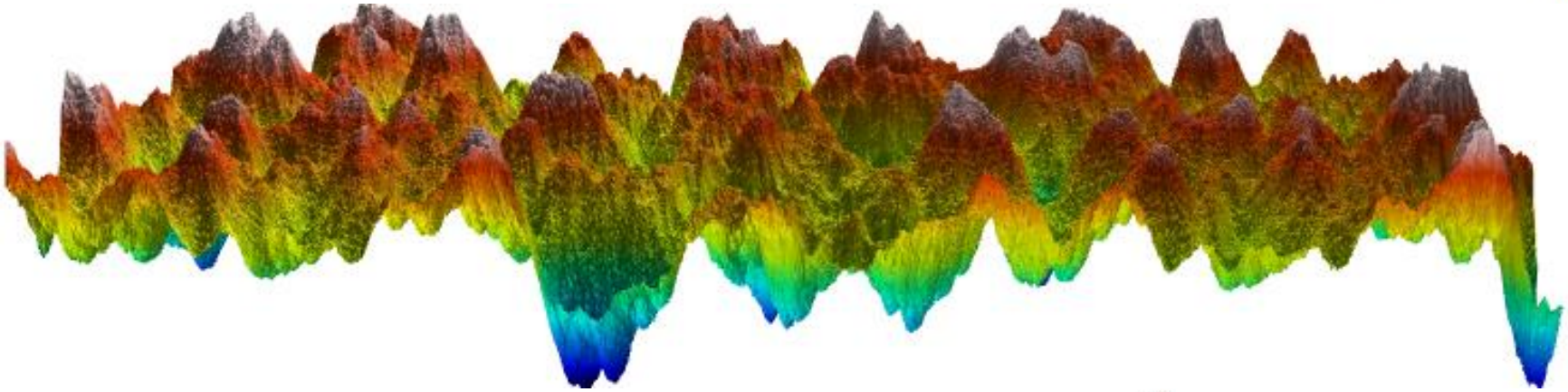


Num. points	200
Y Max	1.0016

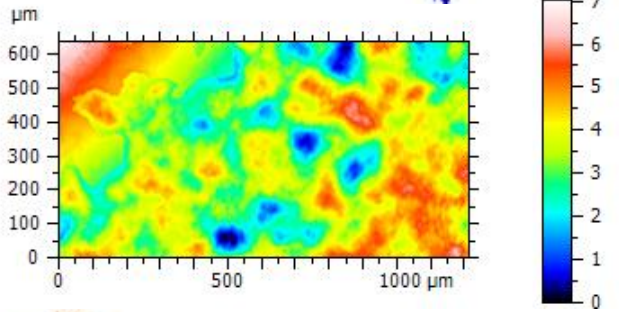
NPL AIR B40

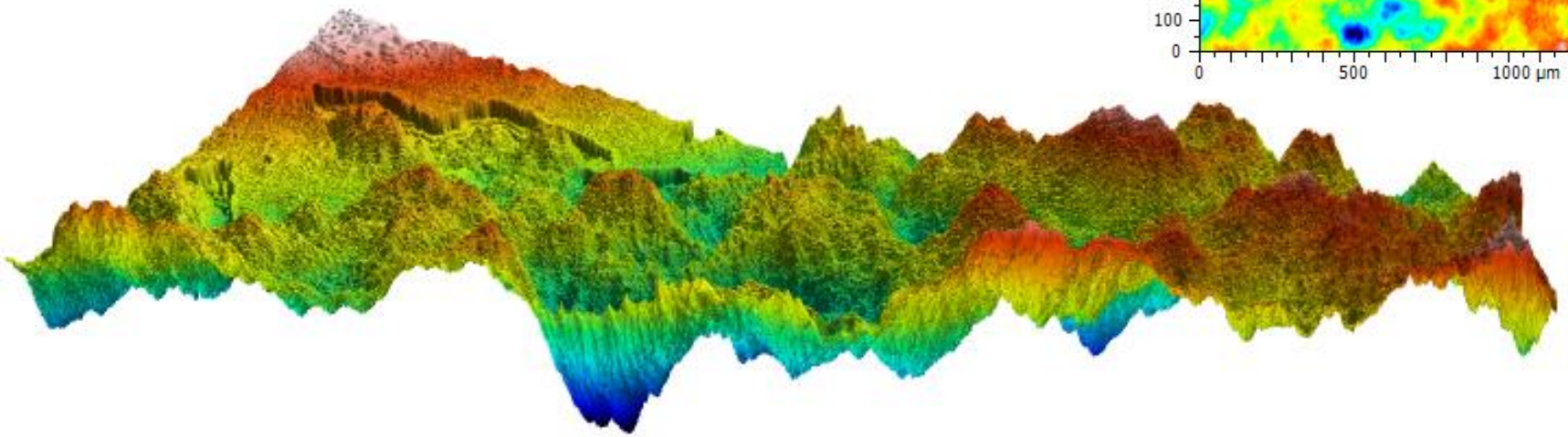
Mesuré avec un microscope confocal à balayage laser. Rendu dans MountainsMap



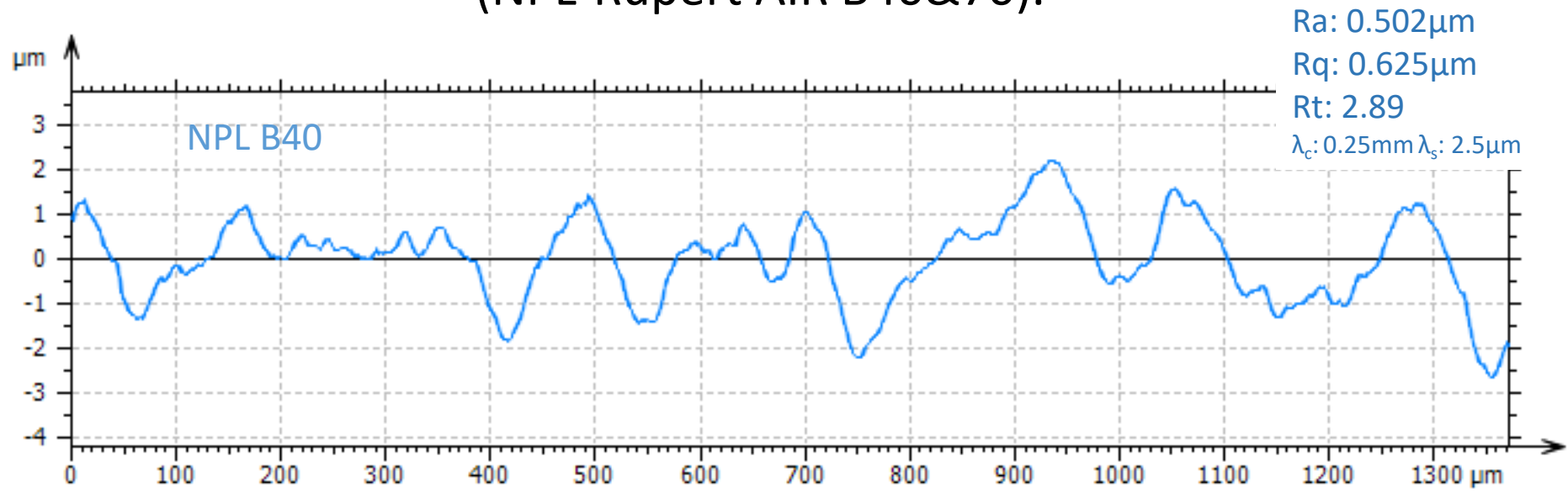


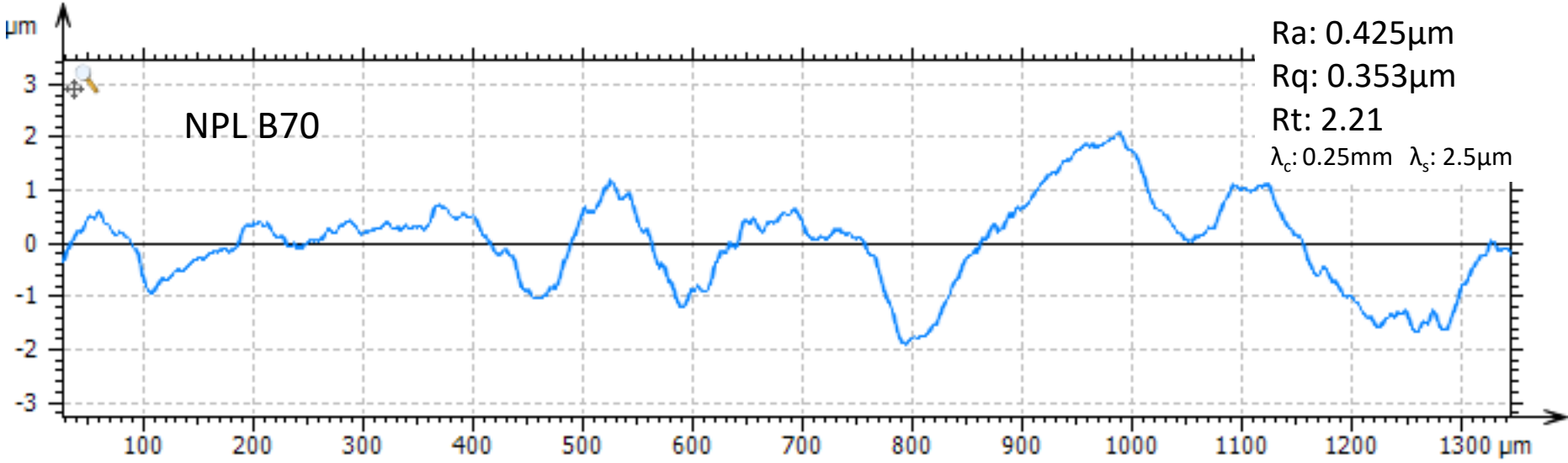
NPL AIR B70



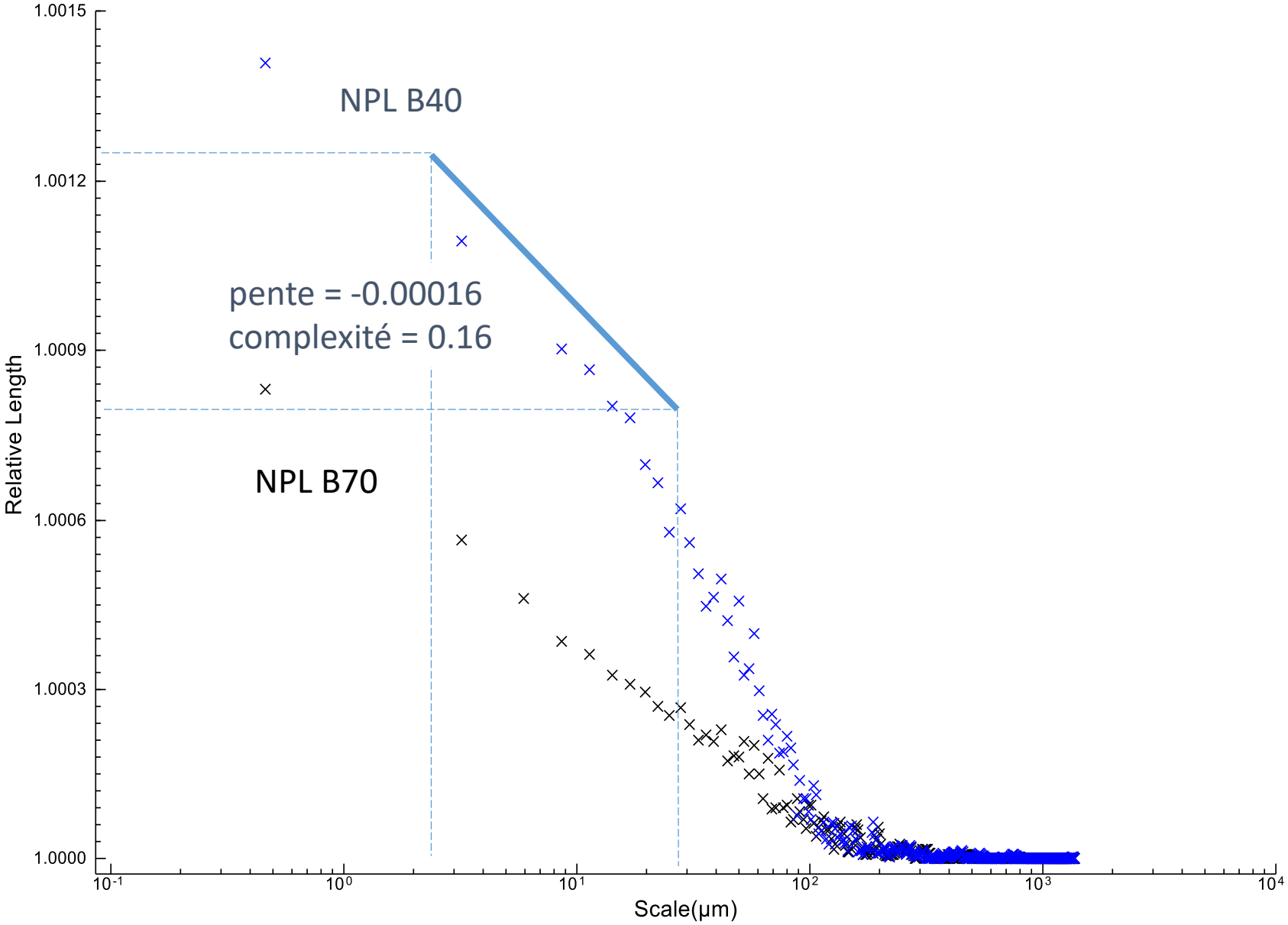


Profils extraits de surfaces irrégulières (NPL-Rupert AIR B40&70).

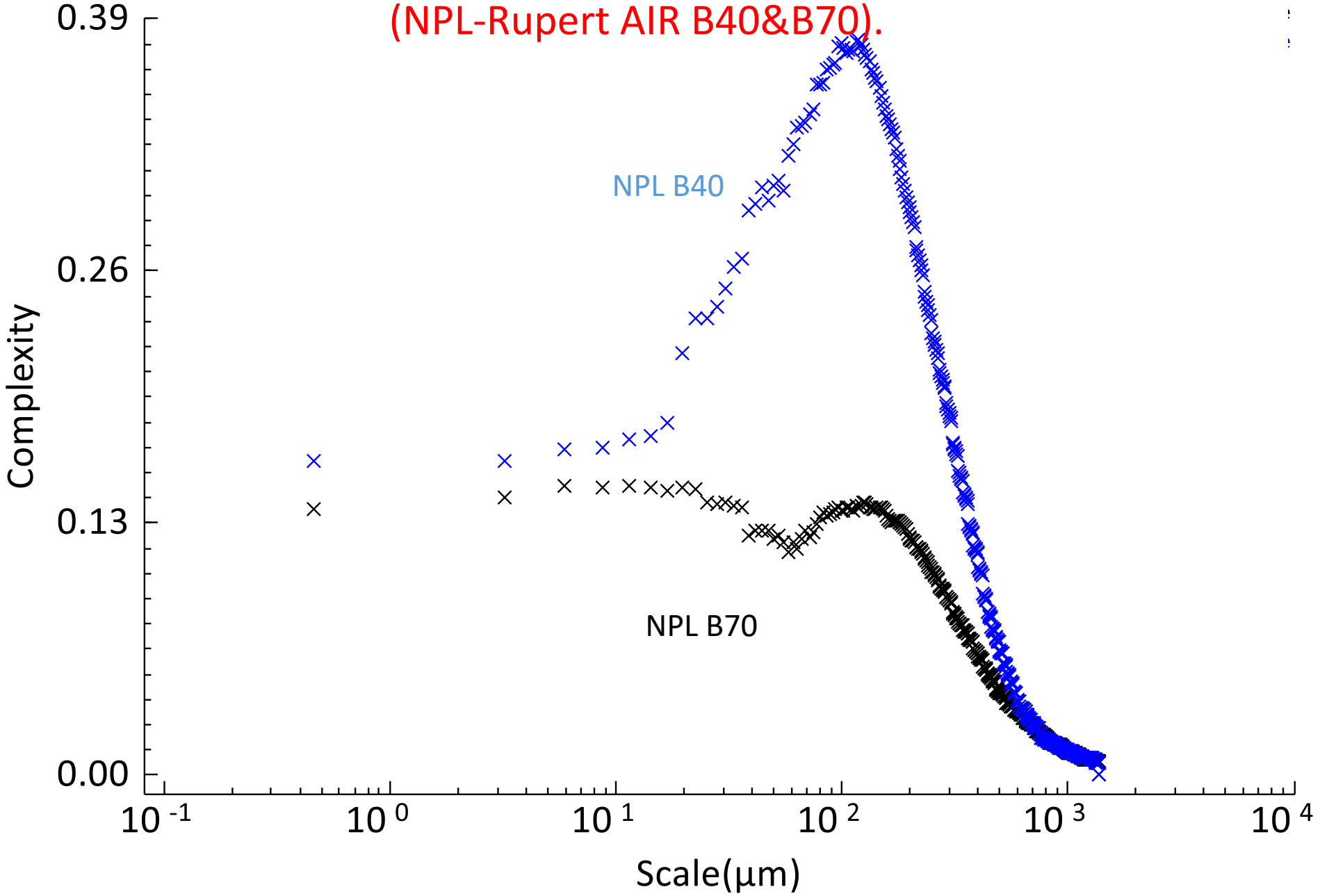




Graphe “Length-scale” sur profil irrégulier (NPL-Rupert AIR B40&B70)

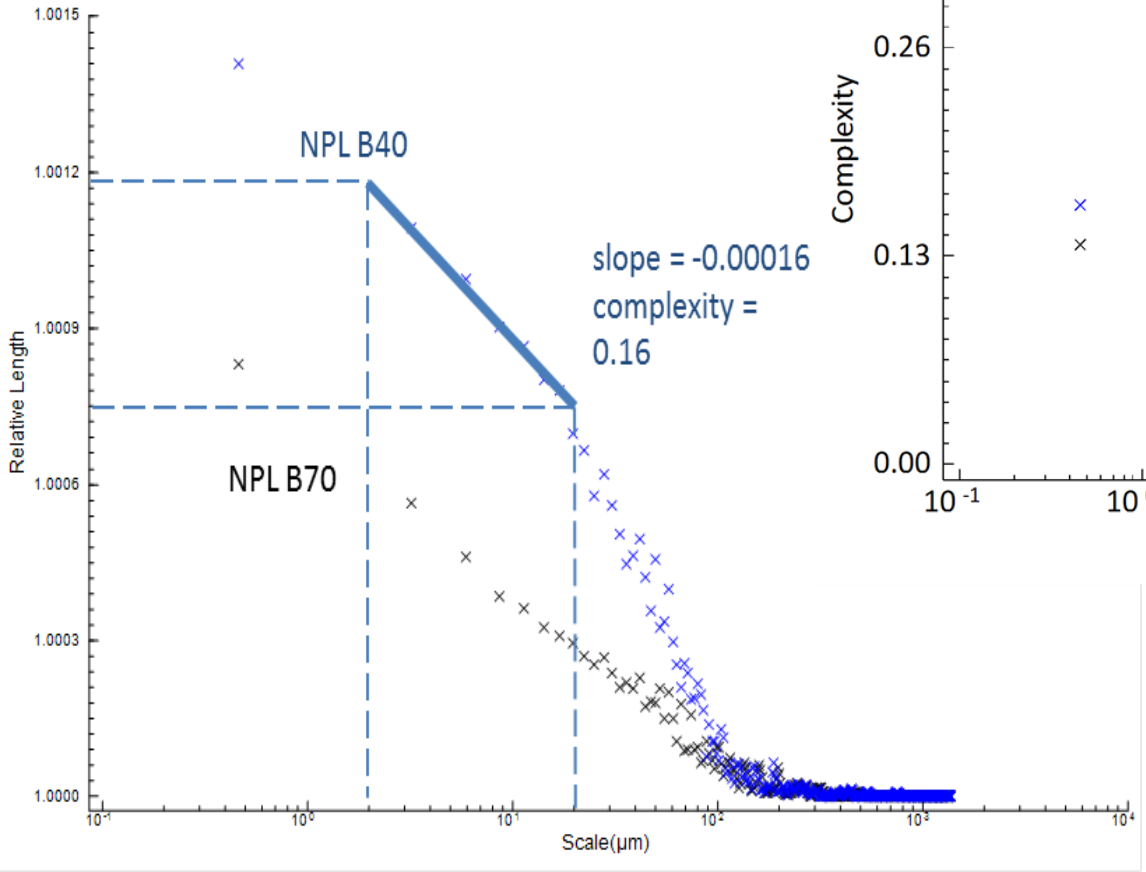


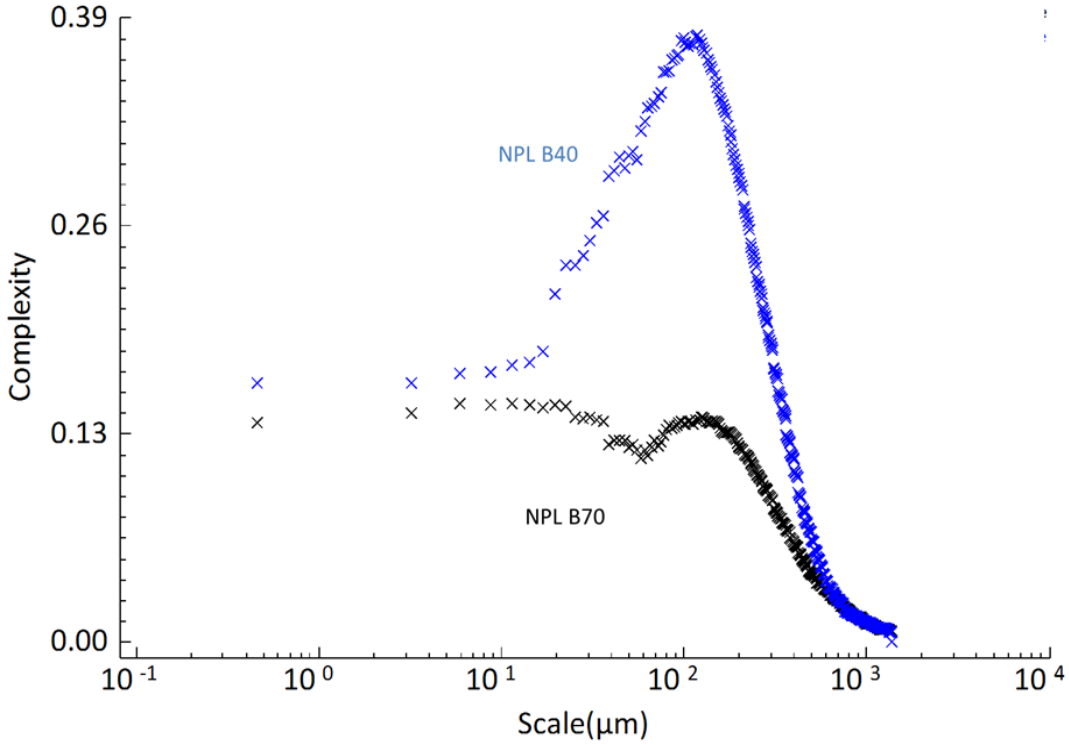
Graphe “Complexity-scale” sur profil irrégulier (NPL-Rupert AIR B40&B70).



Bases géométriques de la complexité multi-échelle

Complexité : "dérivée" de la longueur relative ou de l'aire relative en fonction de l'échelle





Analyse « Area-scale »

Patchwork Method U.S. Patent 5,307,292 (1994)

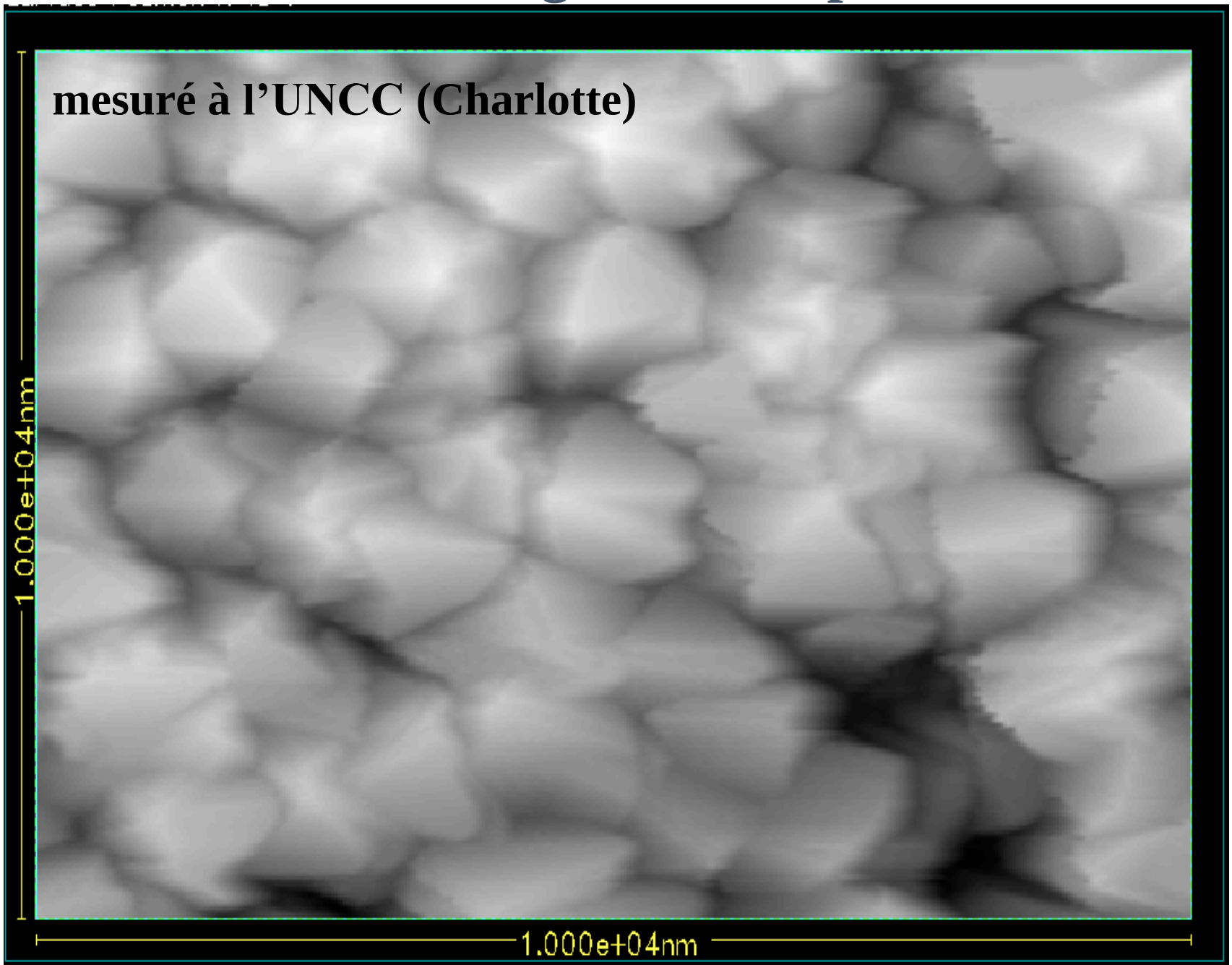
ASME/ANSI B46.1 ch10 2002 & 2009

ISO 25178-2 Spécifications géométriques des produits (GPS)
États de surface *: Surfacique -- Partie 2 : Termes, définitions et paramètres d'états de surface*

- Couverture virtuelle « tiling »
  - tuiles triangulaires (tiles)
  - la surface de la tuile représente l'échelle d'analyse
  - on calcule l'aire apparente en fonction de l'échelle

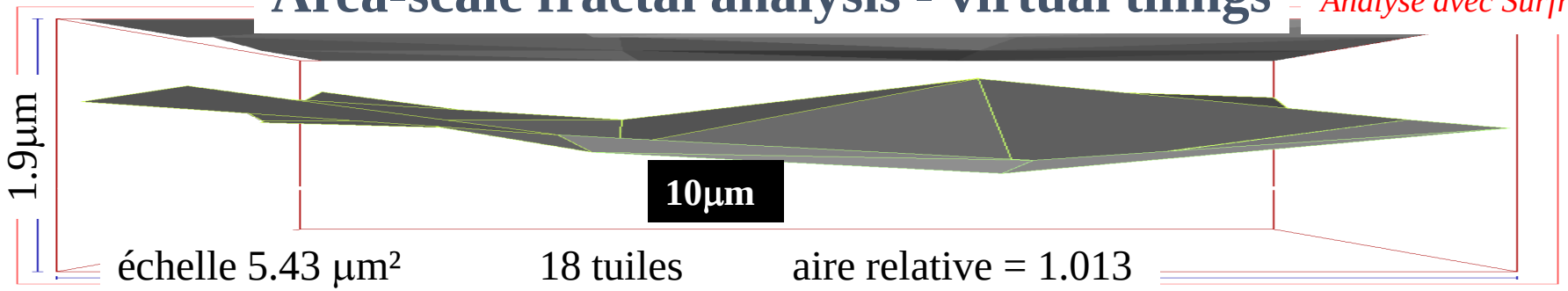
- Calcul de **l'aire relative** = $\frac{\textbf{aire calculée}}{\textbf{aire nominale}}$
- Tracé de l'aire relative vs échelle

Diamond Coating - Nanoscope II STM

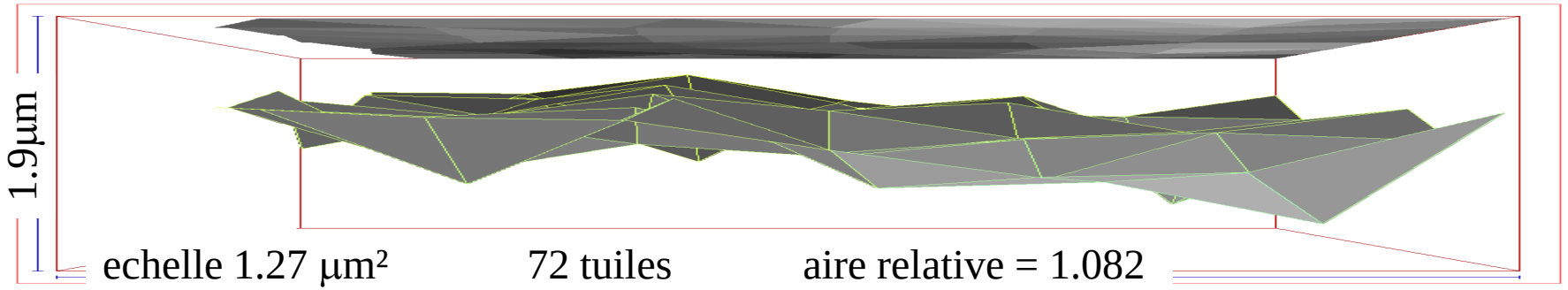


Area-scale fractal analysis - virtual tilings

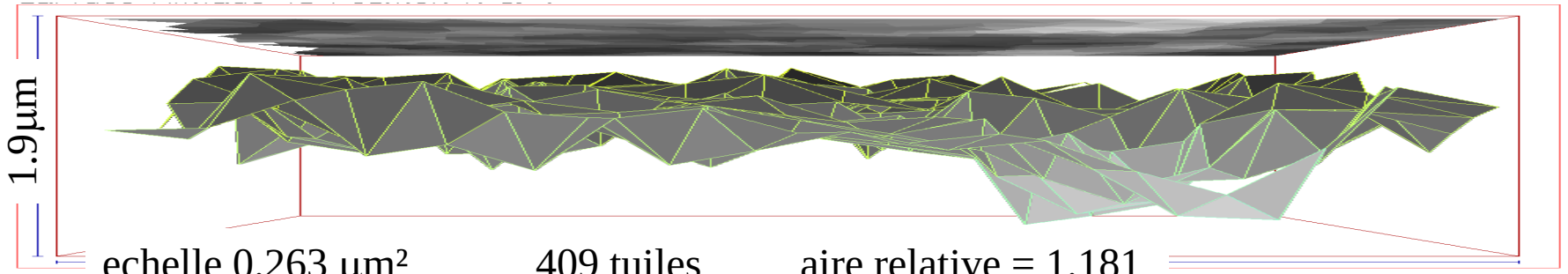
Analyse avec Surfrax



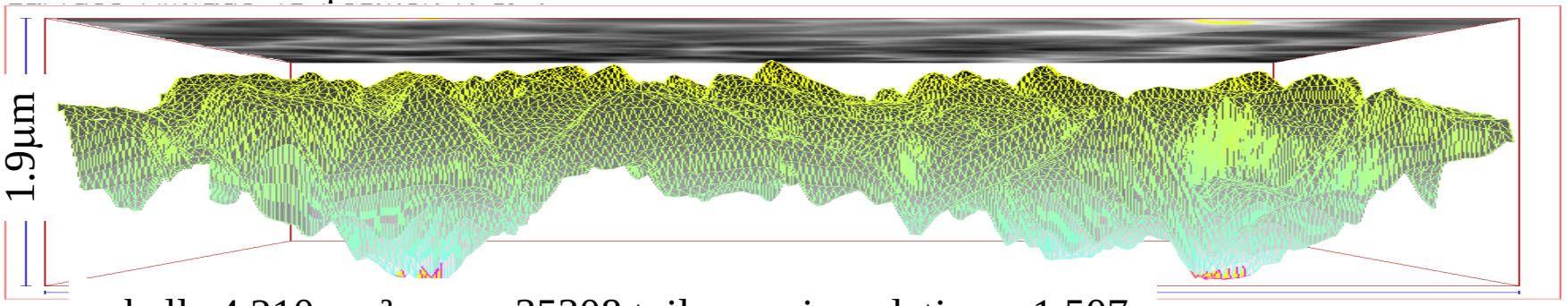
échelle 5.43 µm² 18 tuiles aire relative = 1.013



echelle 1.27 µm² 72 tuiles aire relative = 1.082

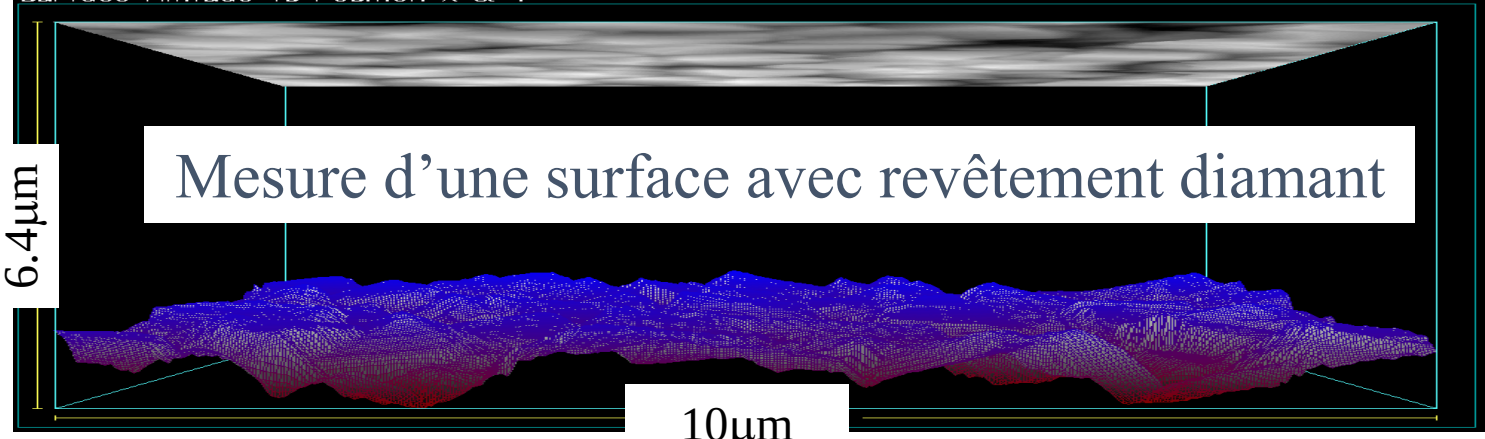


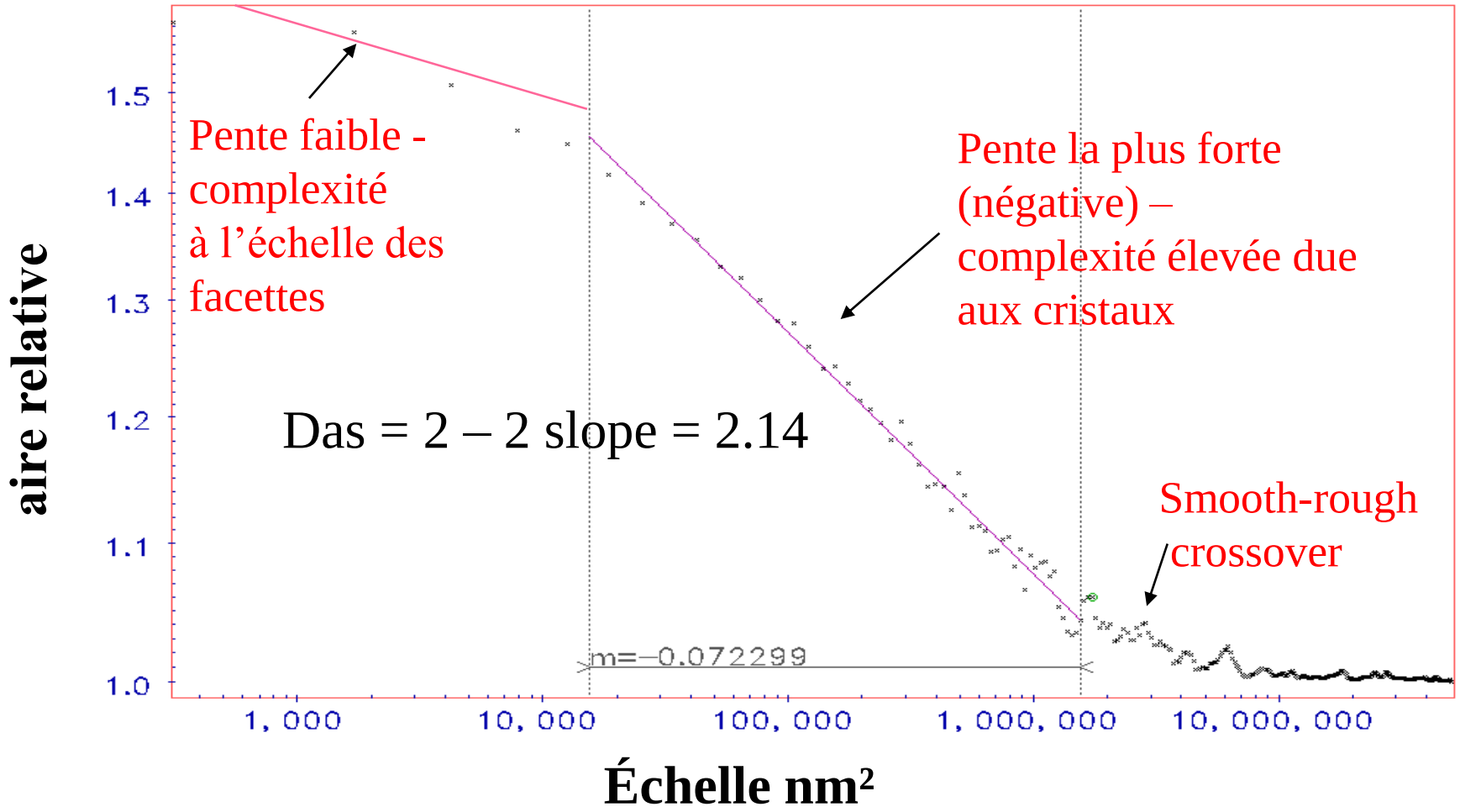
echelle 0.263 µm² 409 tuiles aire relative = 1.181



echelle 4,210 nm² 35308 tuiles aire relative = 1.507

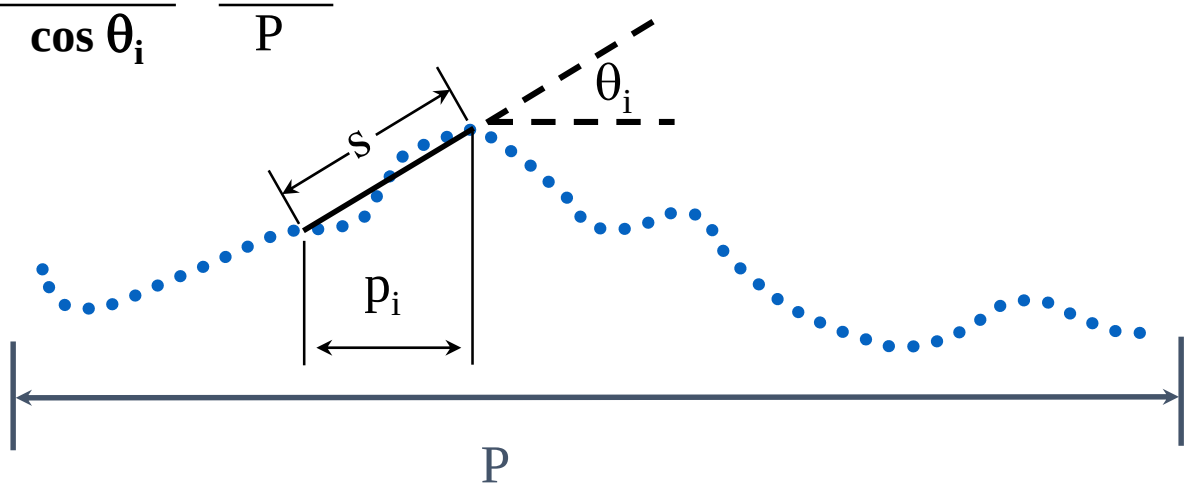
Area-scale plot





Lien avec la pente sur la surface

$$\text{Longueur relative (s)} = \sum_{i}^{N} \frac{\mathbf{1}}{\mathbf{\cos \theta_i}} \quad \frac{p_i}{P}$$



θ_i = angle du $i^{ème}$ segment

s = longueur du segment (échelle d'analyse)

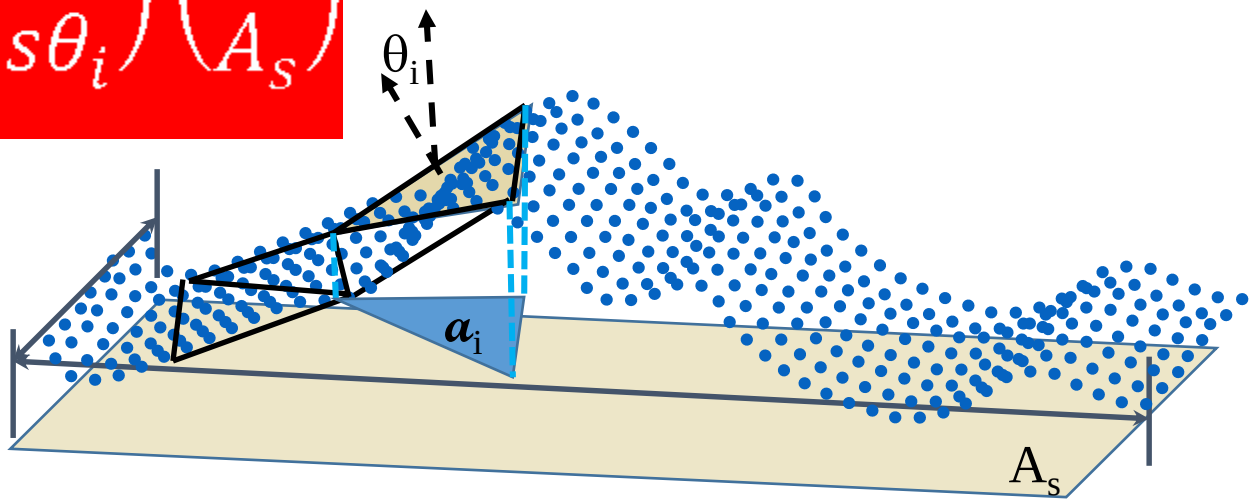
p_i = longueur projetée du $i^{ème}$ segment

P = longueur projetée totale

Aire relative ~ Longueur relative

Lien avec la pente sur la surface

$$RelA_s = \sum_{i=1}^{i=n} \left(\frac{1}{cos\theta_i}\right)\left(\frac{a_i}{A_s}\right)$$

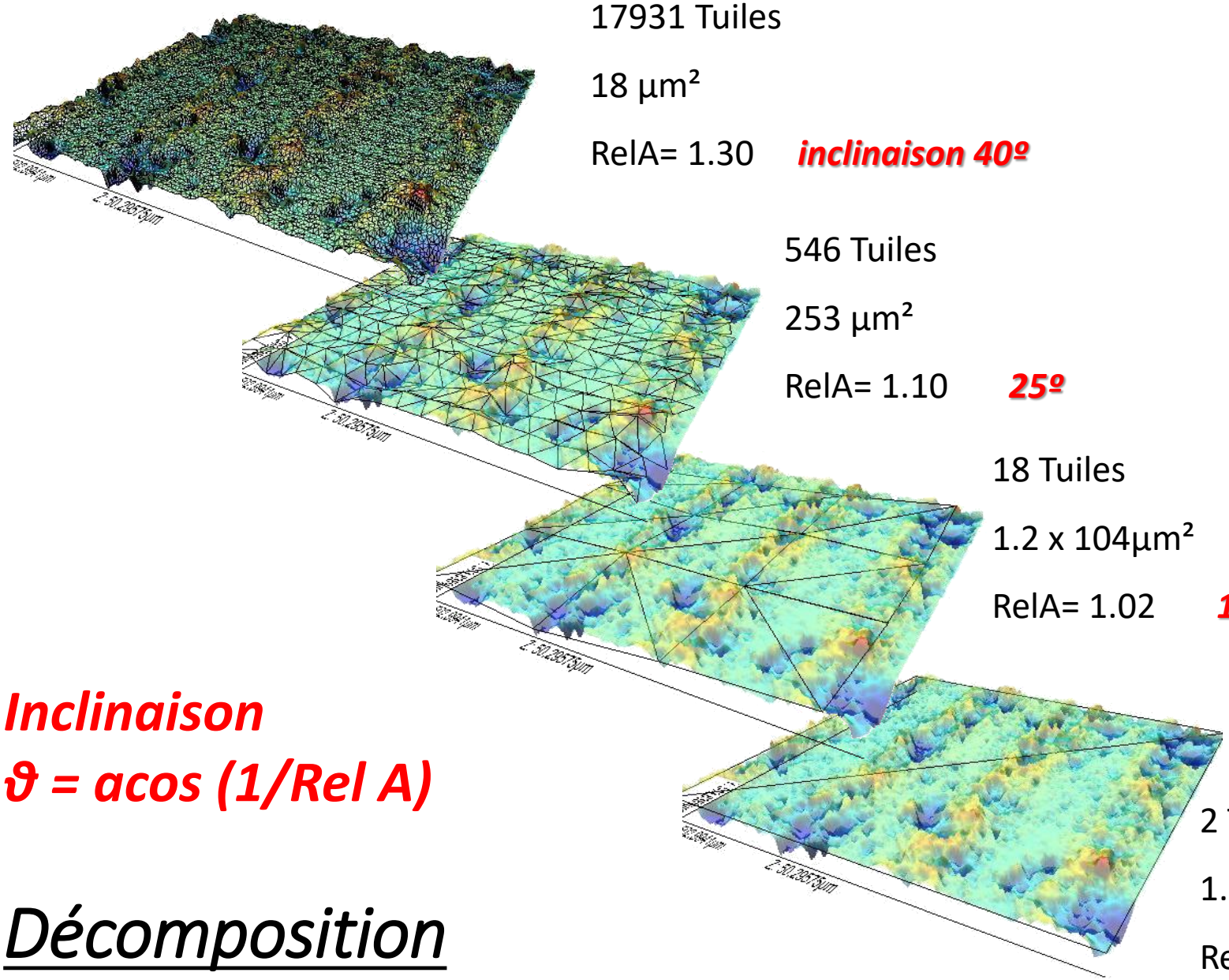


s = Aire du triangle en 3D (échelle d'analyse)

θ_i = Pente du $i^{ème}$ triangle

A_s = Aire projetée totale

$\boldsymbol{a_i}$ = Aire projetée du $i^{ème}$ triangle



17931 Tuiles

18 µm²

RelA= 1.30 ***inclinaison 40º***

546 Tuiles

253 µm²

RelA= 1.10 ***25º***

18 Tuiles

1.2 x 104µm²

RelA= 1.02 ***11º***

2 Tuiles

1.2 x 105 µm²

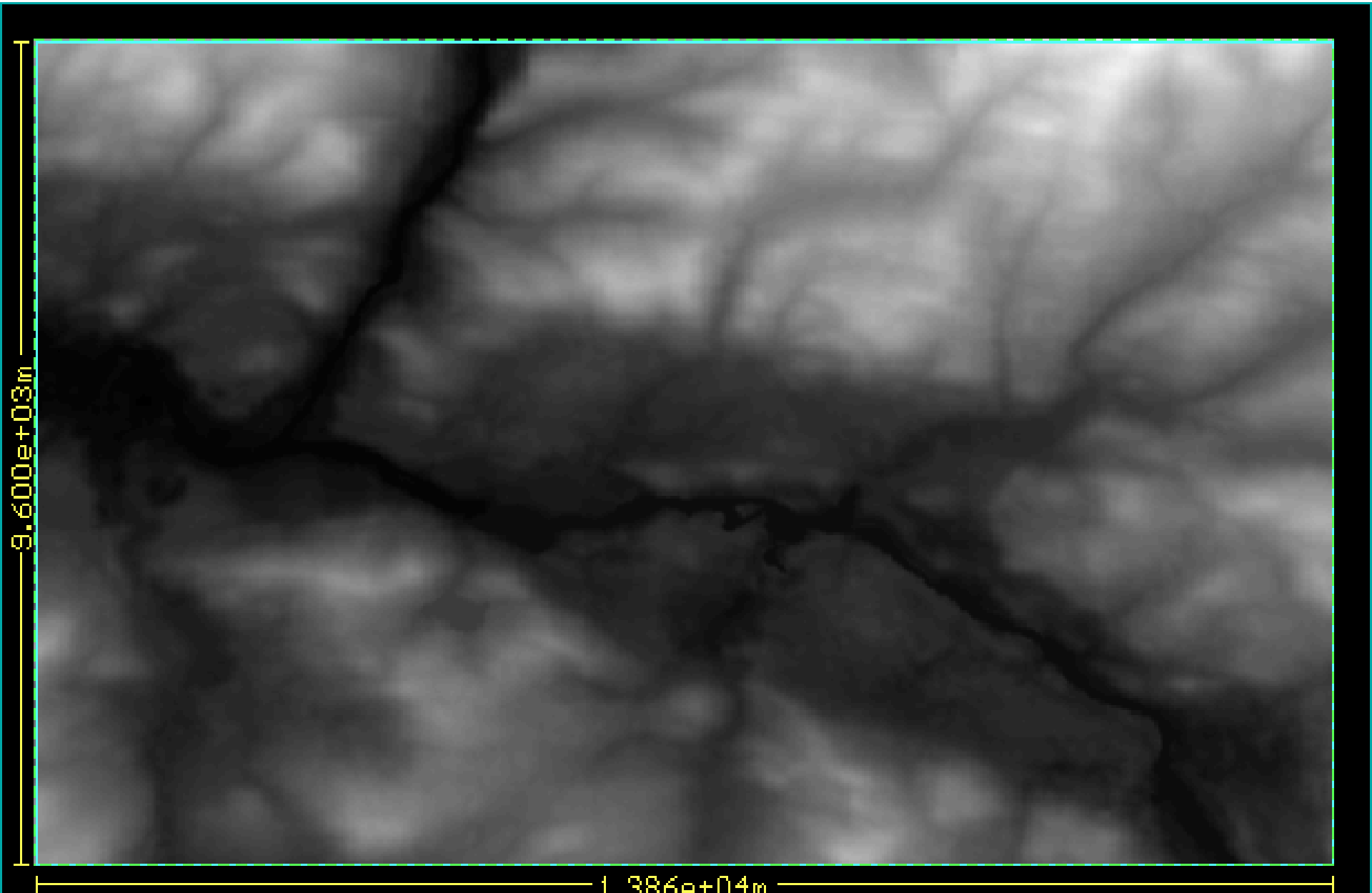
RelA= 1.01 ***8º***

Inclinaison

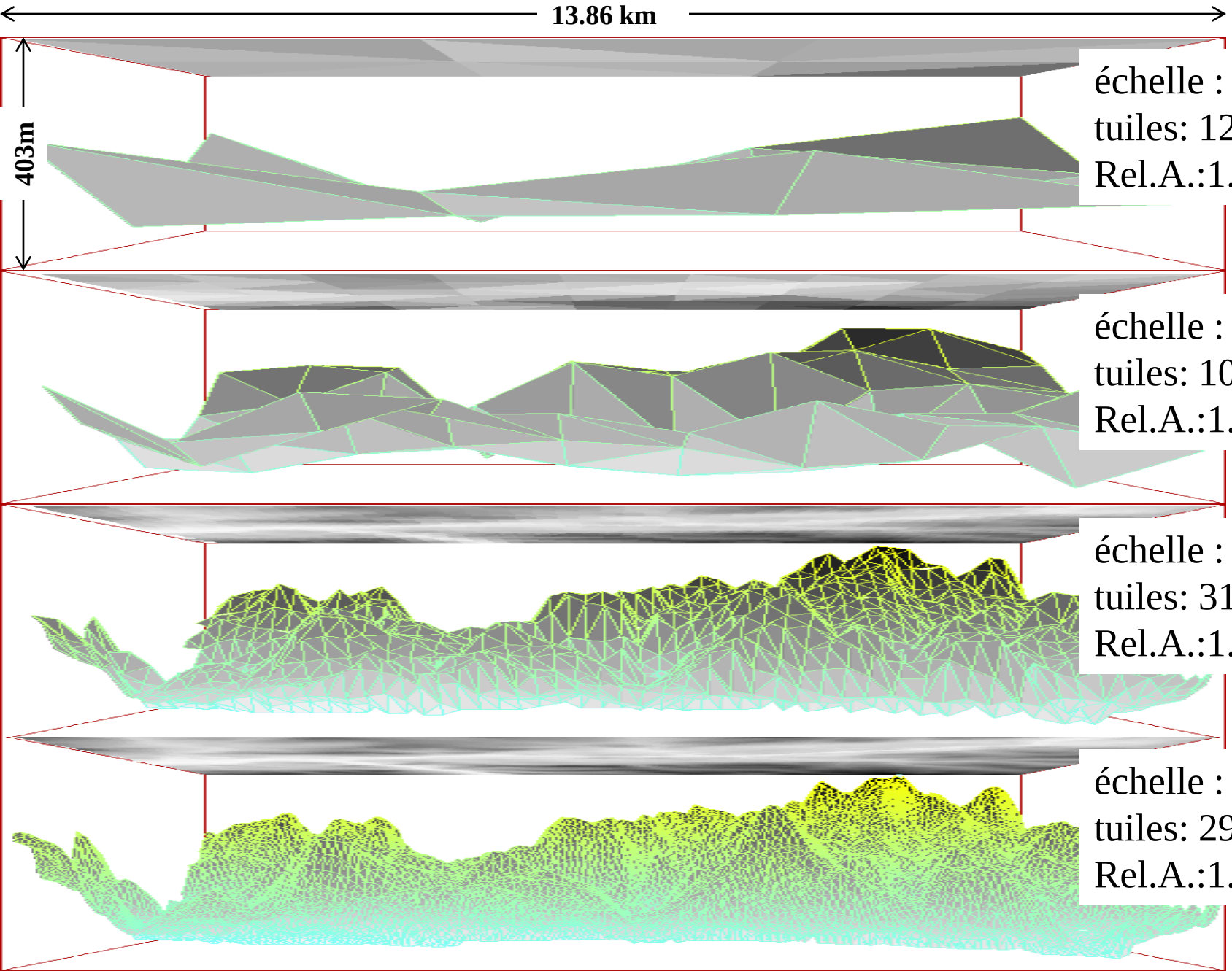
ϑ = acos (1/Rel A)

Décomposition "Area-scale"

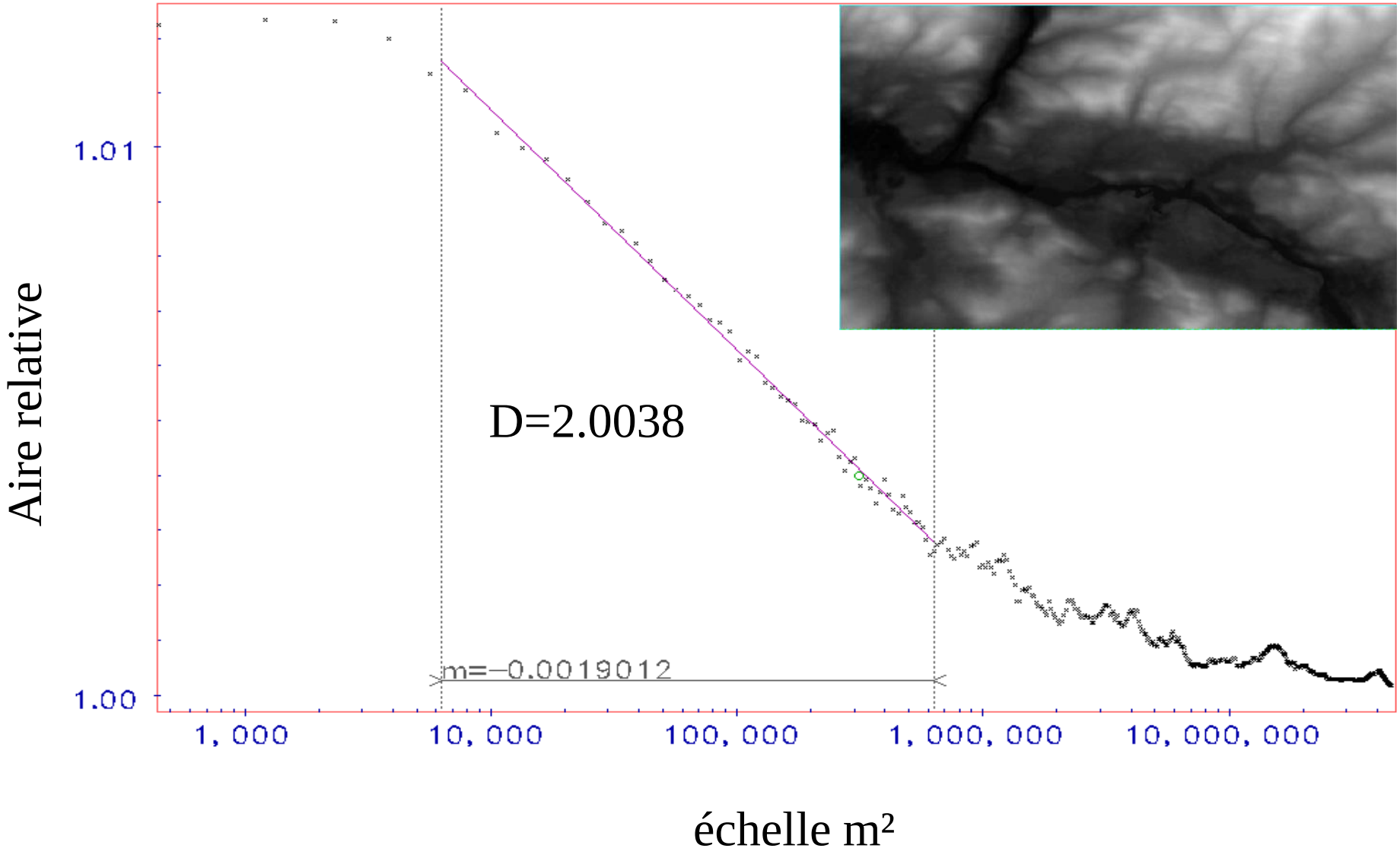
Région d’Hanover



Décomposition sur la région d'Hanover



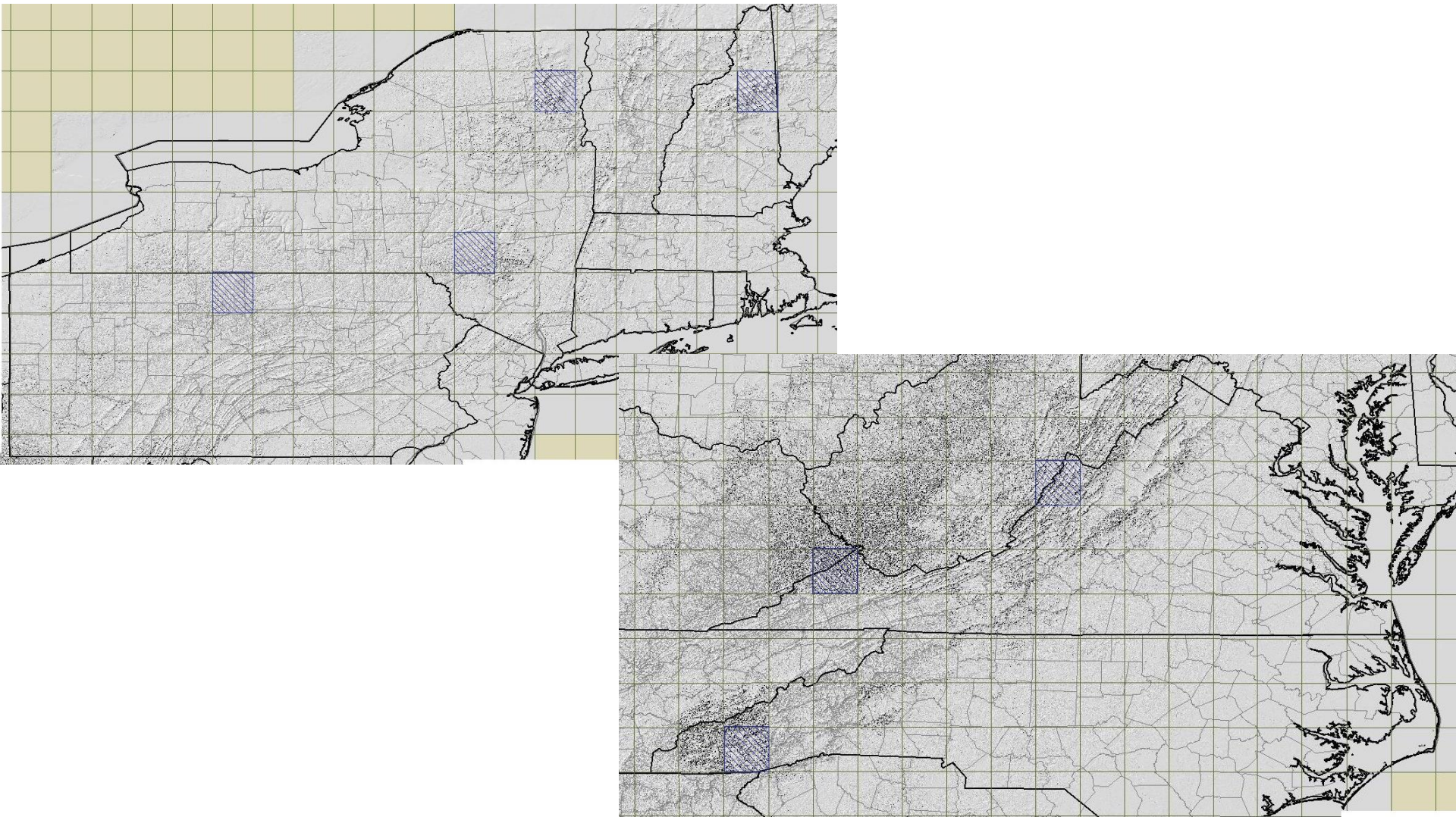
Graphe “Area-scale” de la région d’Hanover



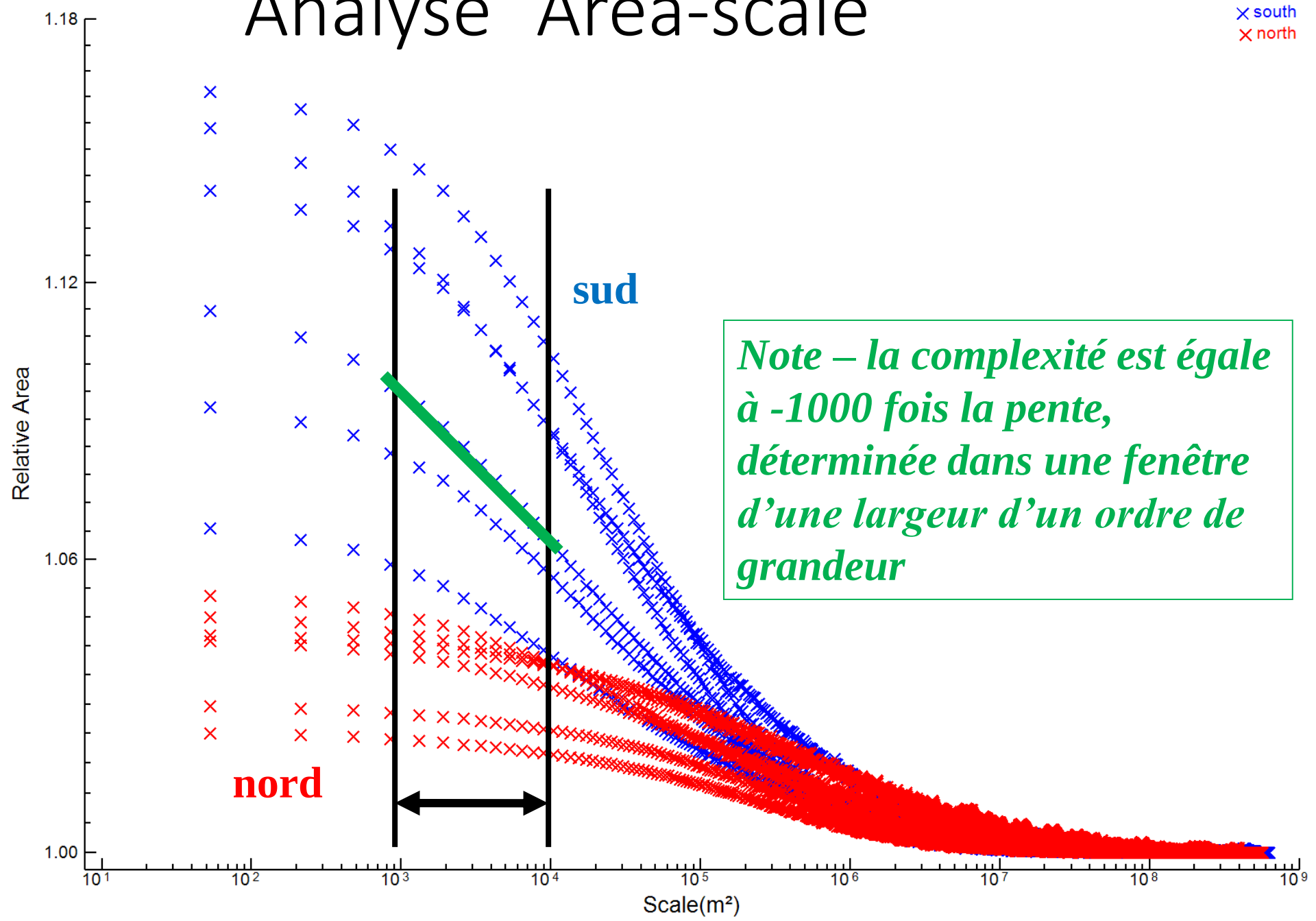
Appalaches du nord *vs* Appalaches du sud

Corey Randall
Christopher A. Brown
Surface Metrology Lab
WPI

Régions analysées

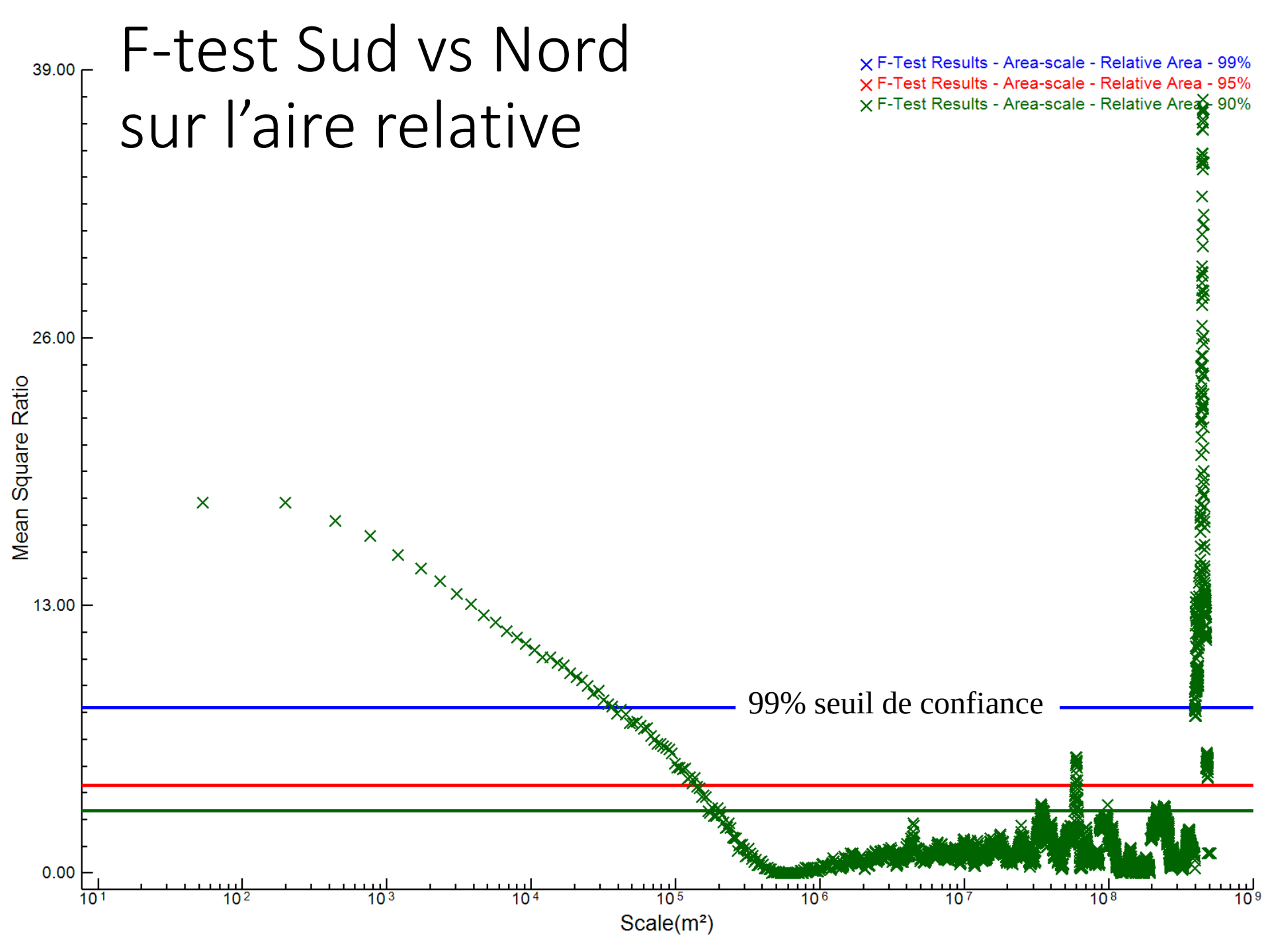


Analyse “Area-scale”

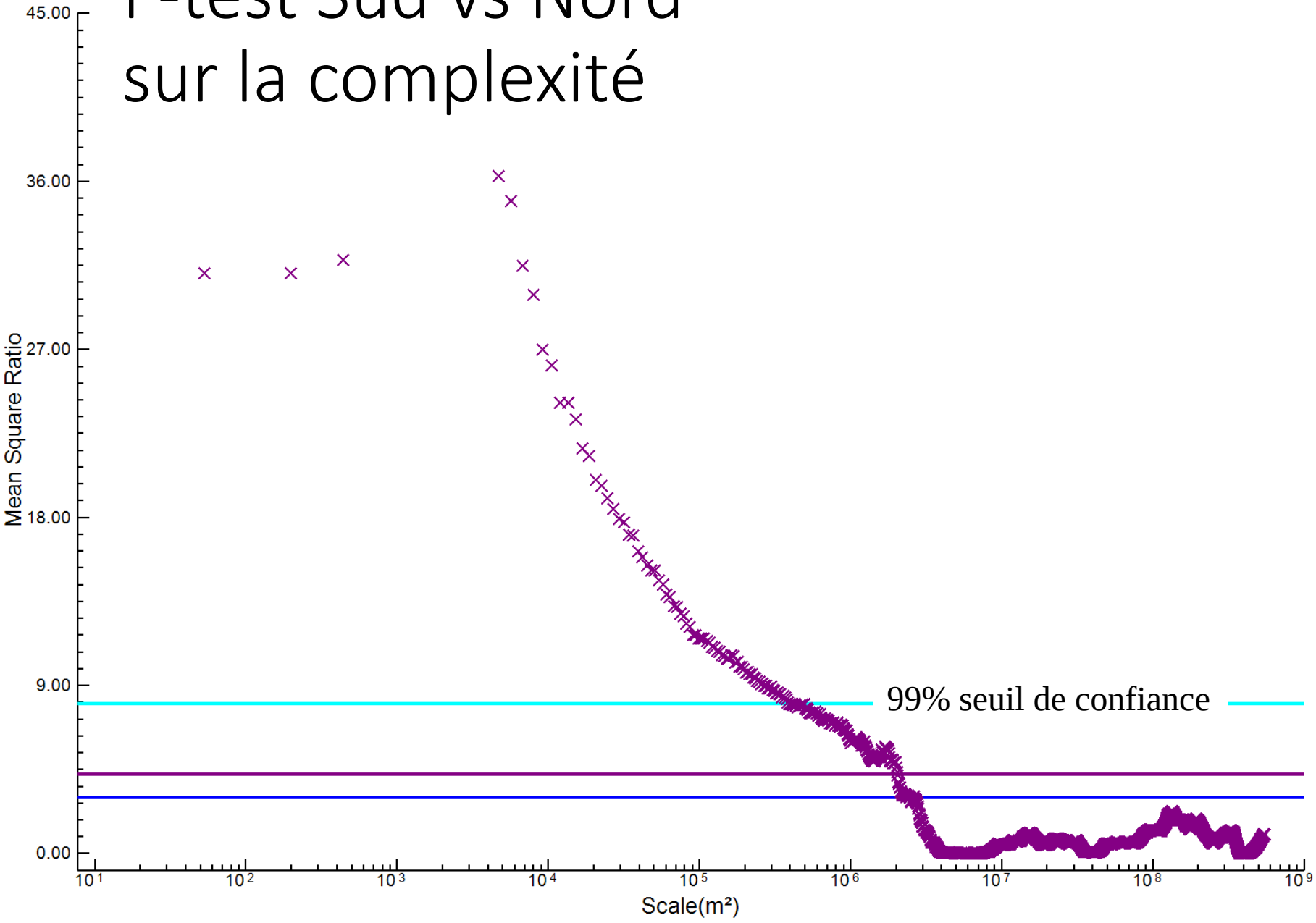


Note – la complexité est égale à -1000 fois la pente, déterminée dans une fenêtre d’une largeur d’un ordre de grandeur

F-test Sud vs Nord sur l'aire relative



F-test Sud vs Nord sur la complexité



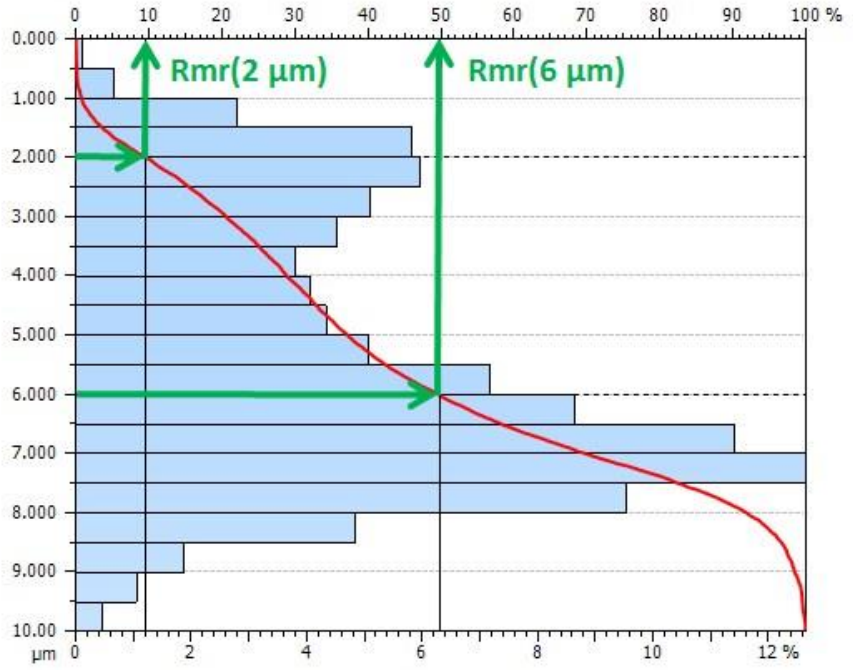
Caractérisation “Filling-scale”

Objectif :

- Caractérisation en fonction de l’échelle de la capacité volumétrique de l’état de surface.

État de l’art :

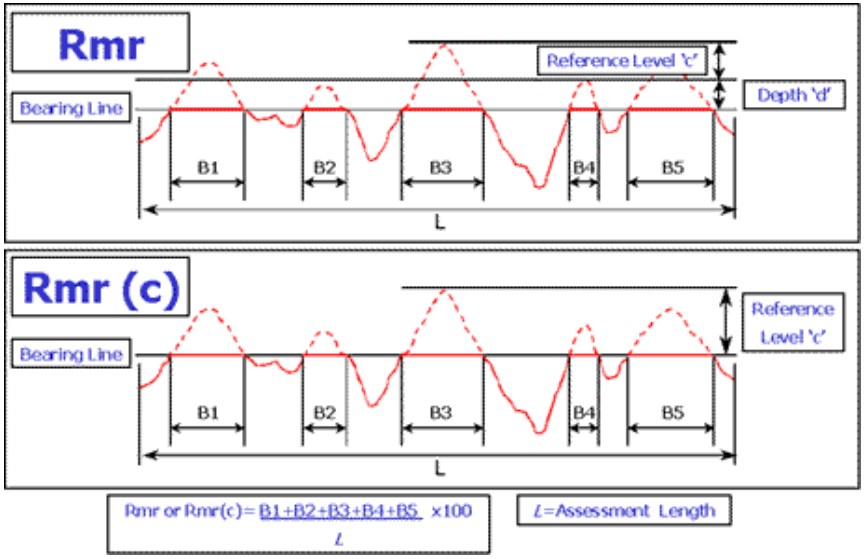
- Taux de portance, courbe d’Abbott-Firestone
  - qui ne sont évaluées qu’à une seule échelle



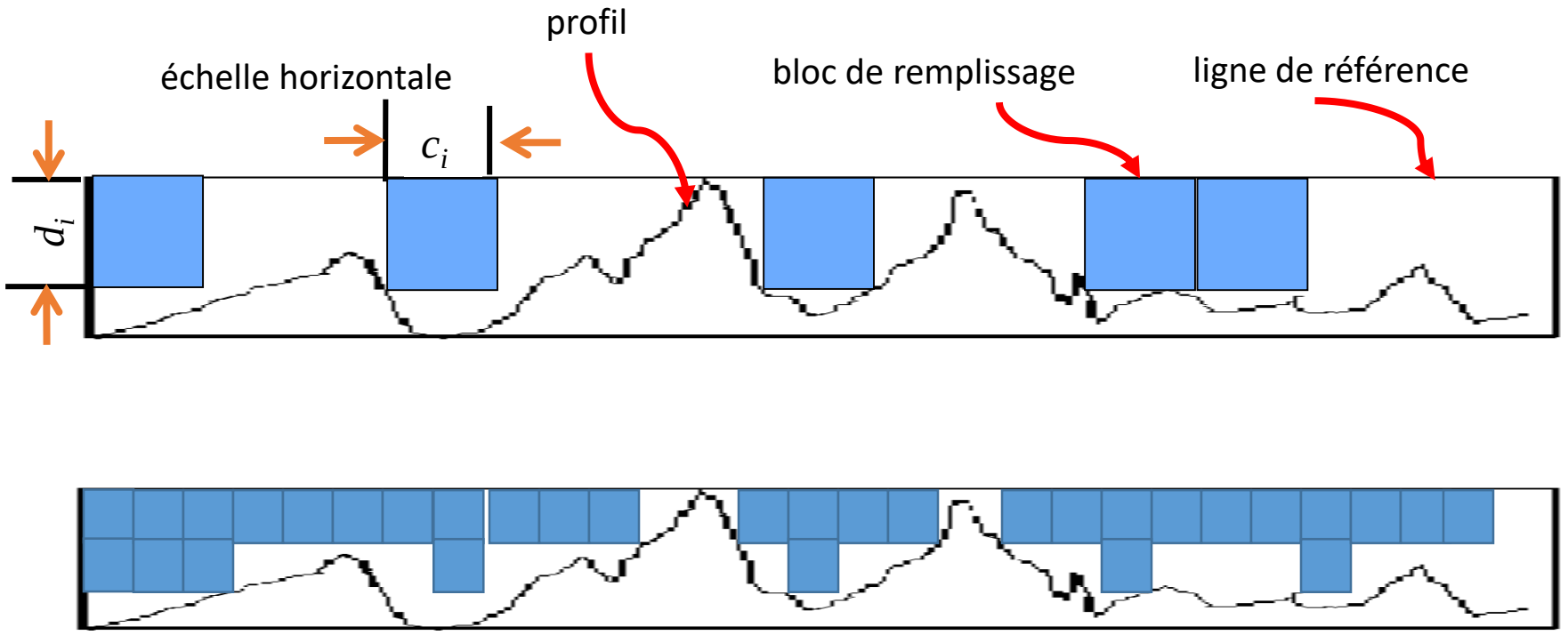
Les courbes de portance donnent le pourcentage de matière située au-dessus du seuil.

Il n'y a aucune information spatiale ou d'échelle.

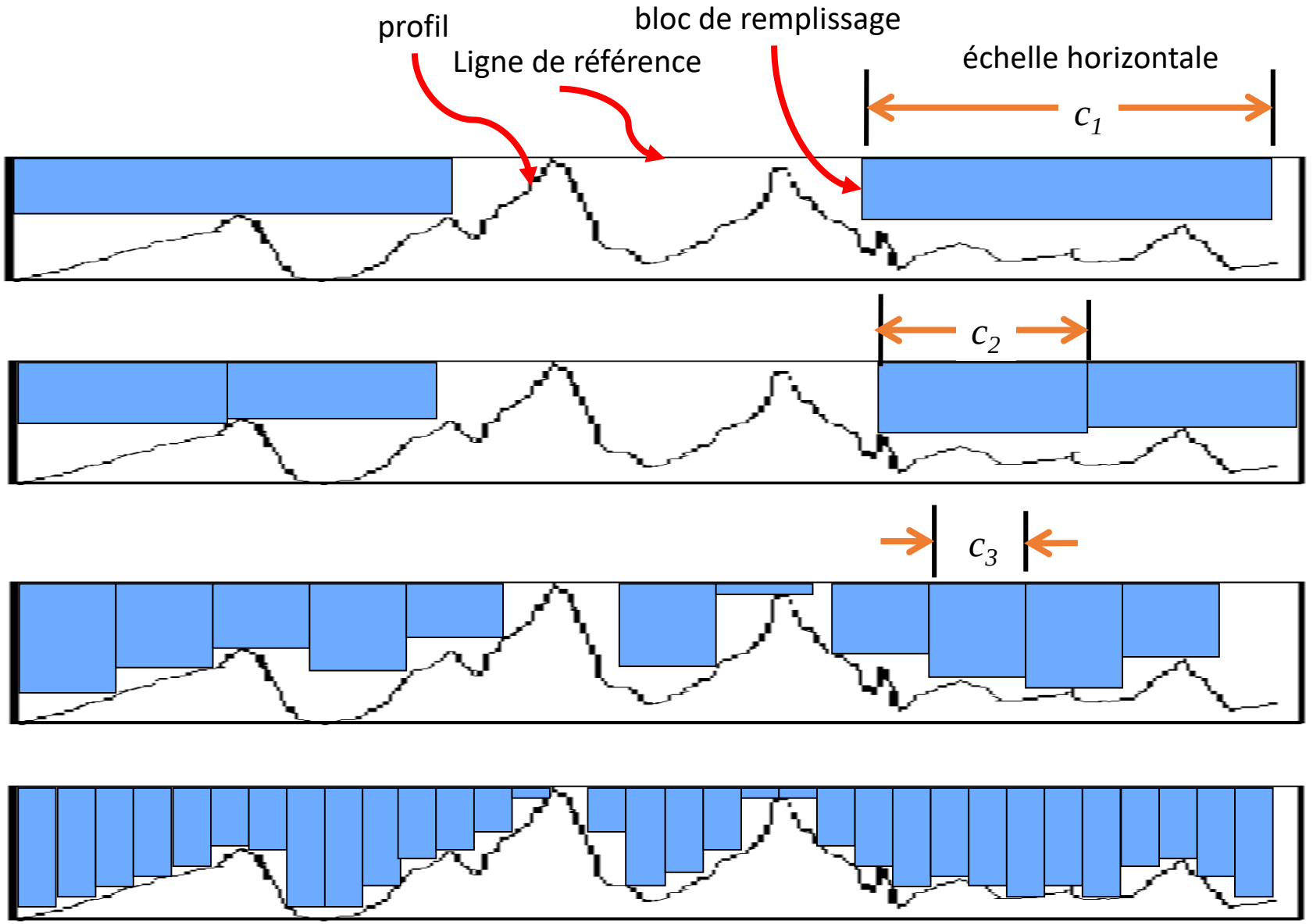
Il est impossible de discriminer entre quelques pics larges ou nombreux pics étroits.



“Filling scale” avec des blocs carrés
(même échelle verticale et horizontale)

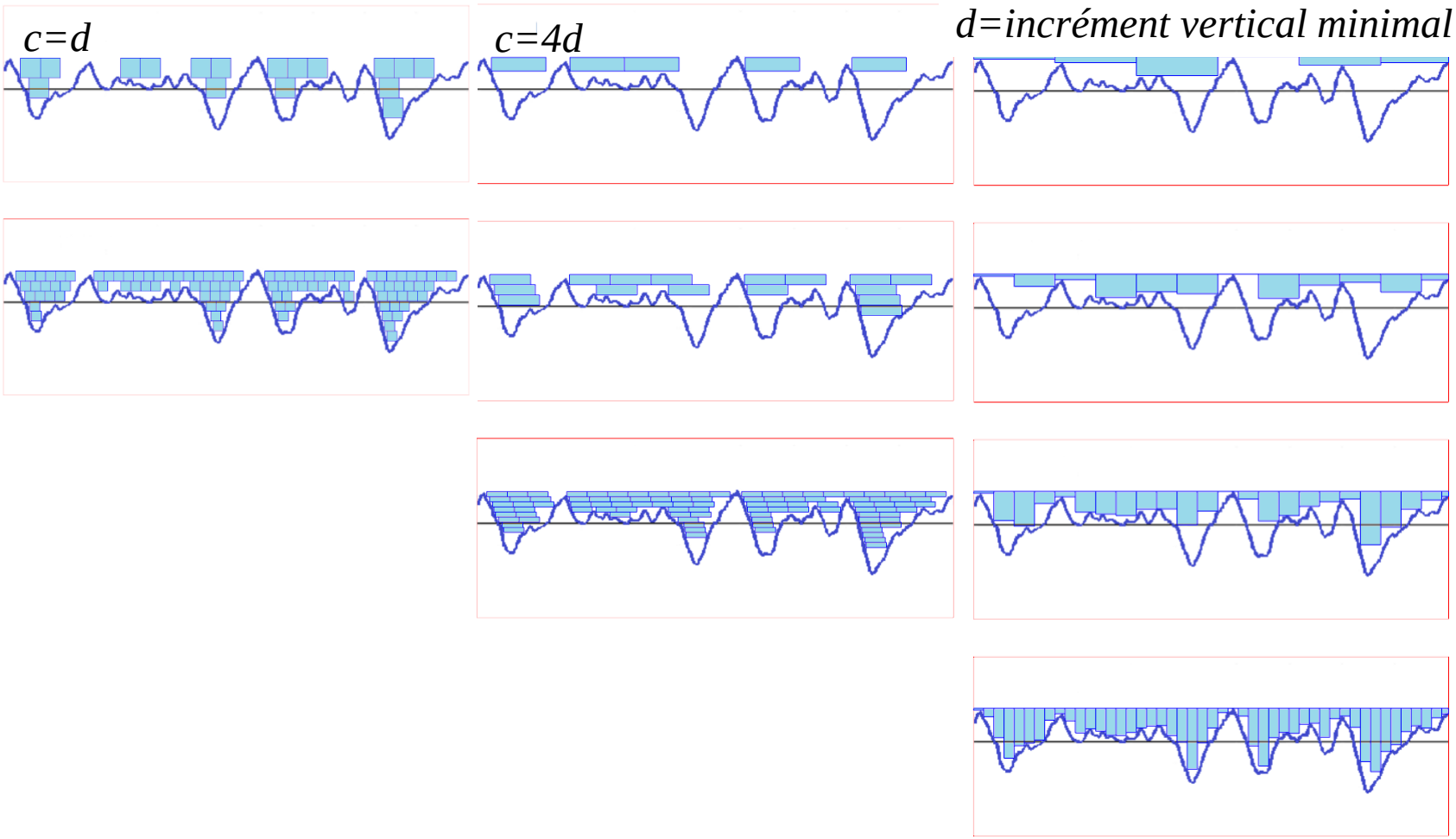


“Filling-scale” incrément vertical minimal



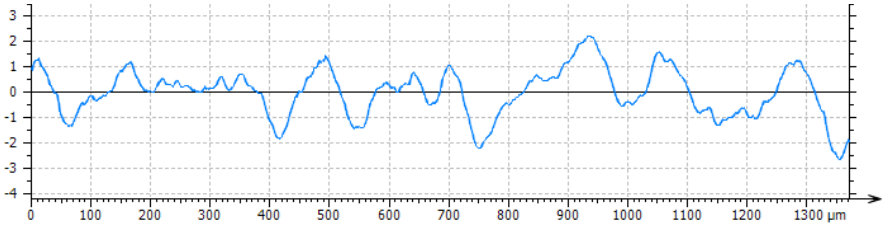
Filling scale

Exemple de remplissage avec trois ratios *c/d*



Fraction de volume rempli en fonction de l'échelle (NPL-Rupert AIR B40)

Fraction remplie = (volume total rempli) / (volume total de vide)



d = incrément vertical minimal

d = 0.1c

d = 0.5c

d = c

L'algorithme nécessite une correction ici

Fraction Filled

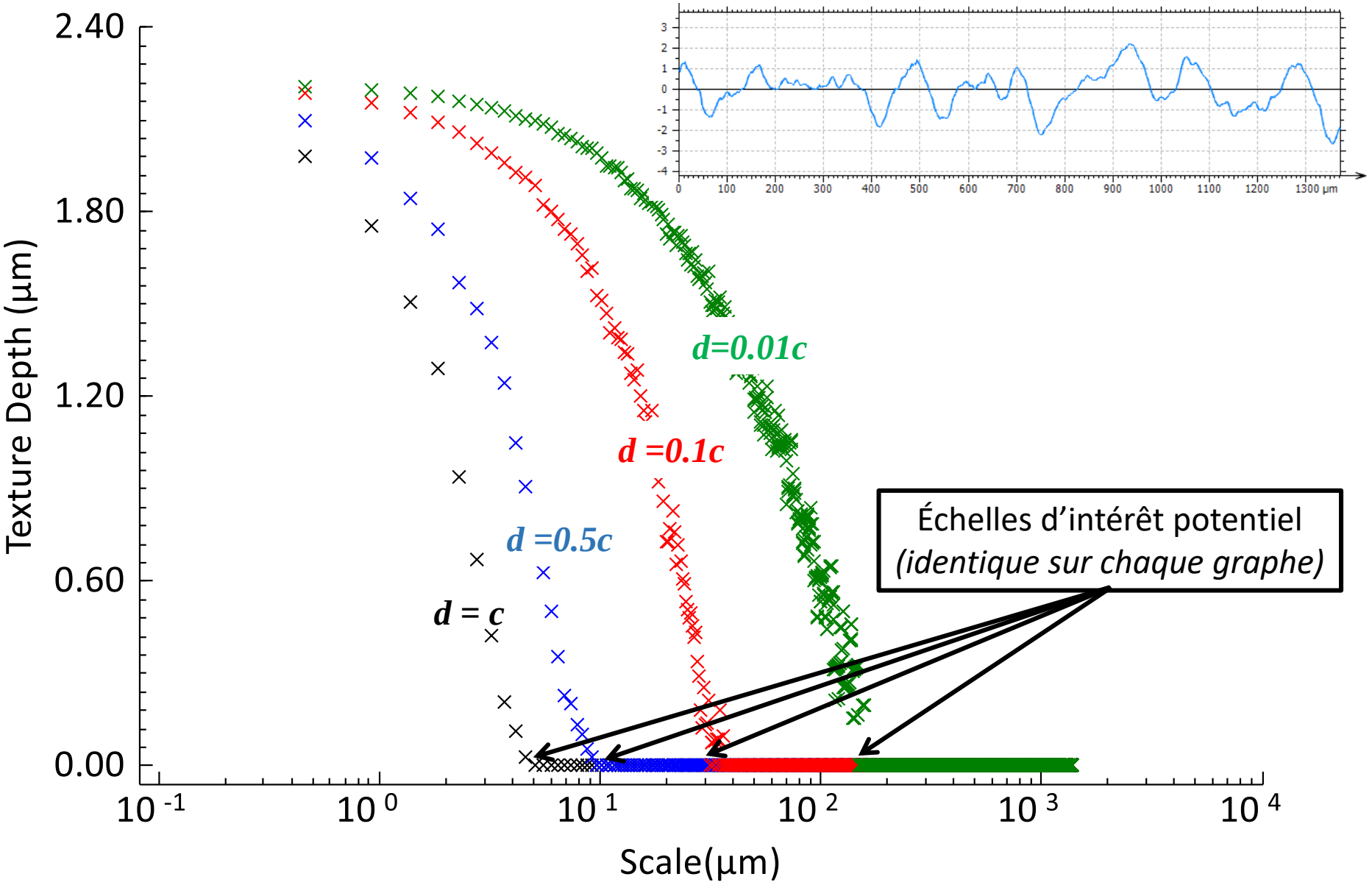
0.48
0.36
.24
0.12
0.00

10^{-1} 10^{0} 10^{1} 10^{2} 10^{3} 10^{4}

Scale (µm)

Fraction de volume rempli en fonction de l'échelle (NPL-Rupert AIR B40)

Fraction remplie = (volume total rempli) / (volume total de vide)




Merci de votre attention !
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