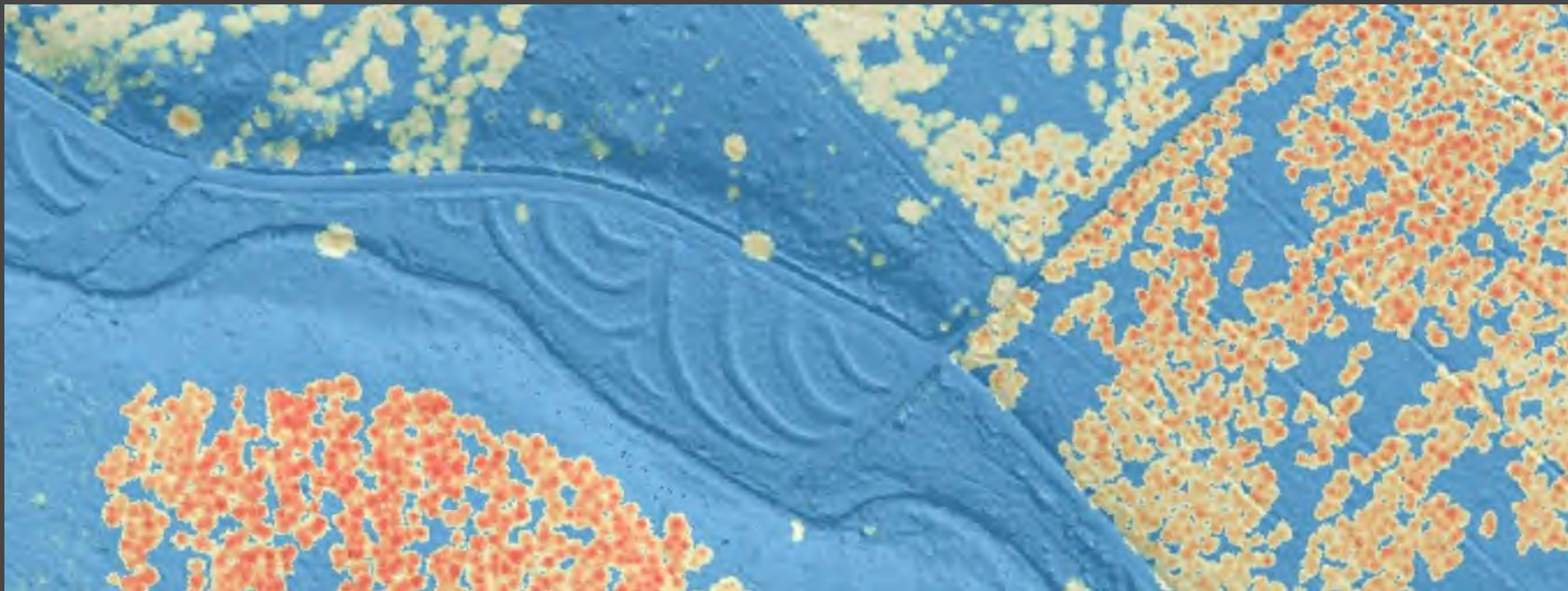
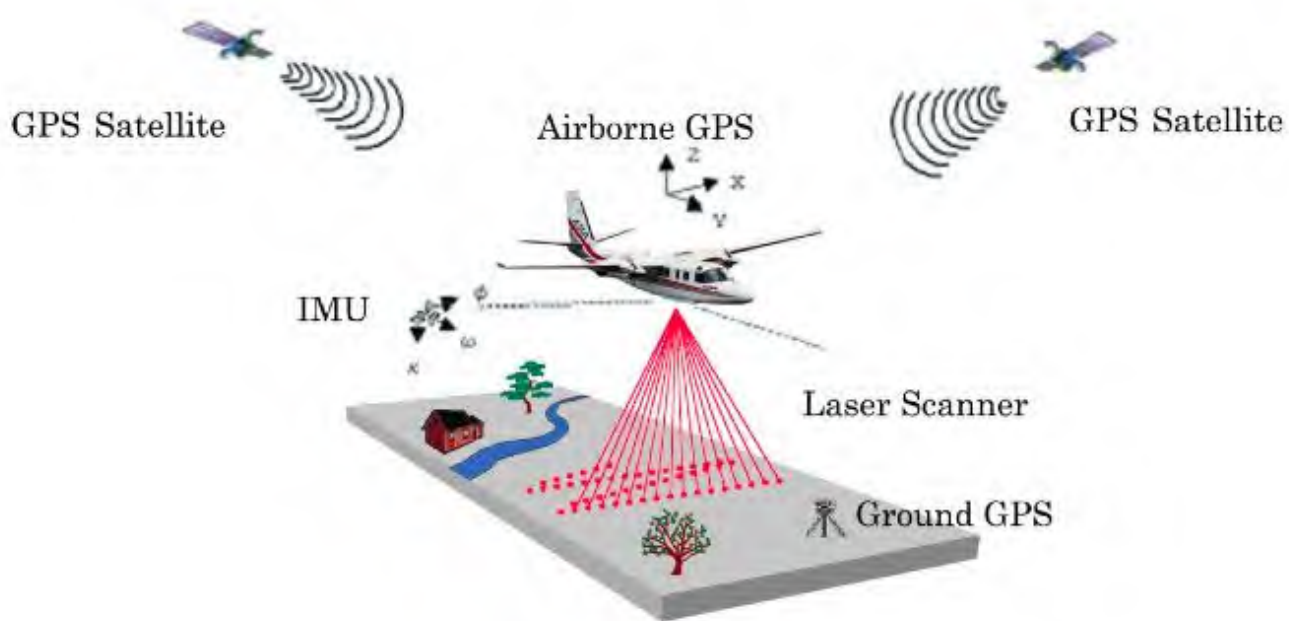


Applications environnementales du lidar

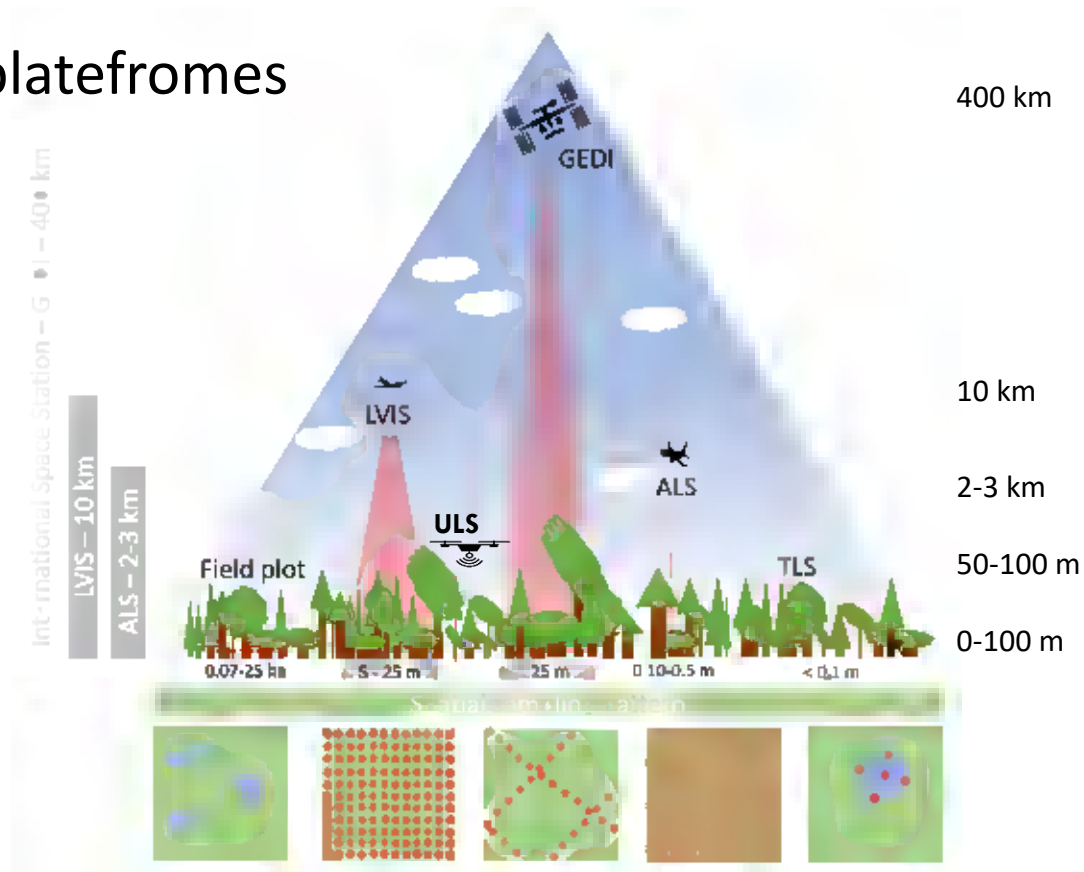


- LiDAR : **L**ight **D**etection **A**nd **R**anging

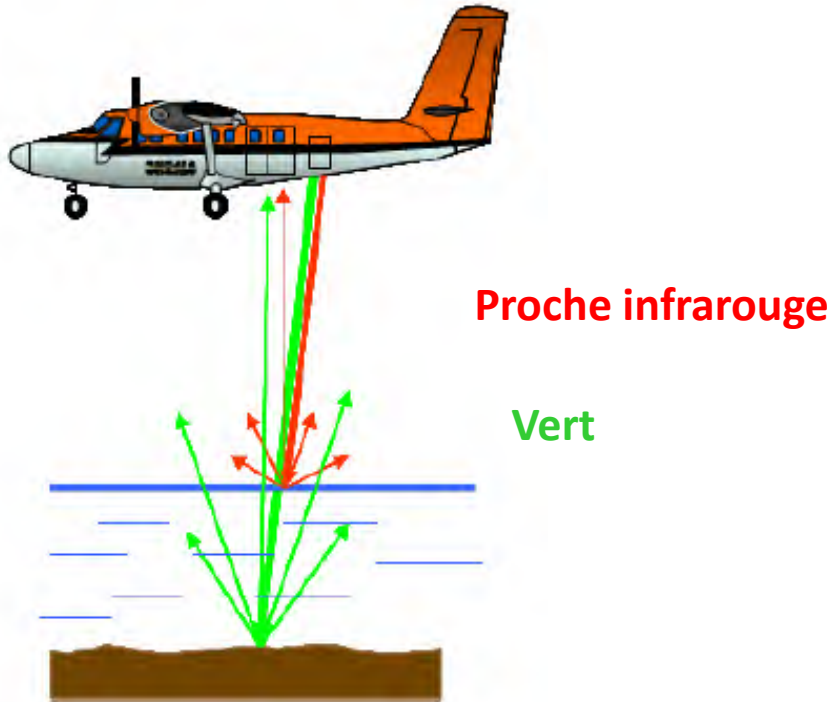
« *Mesure de distance par détection de lumière* »



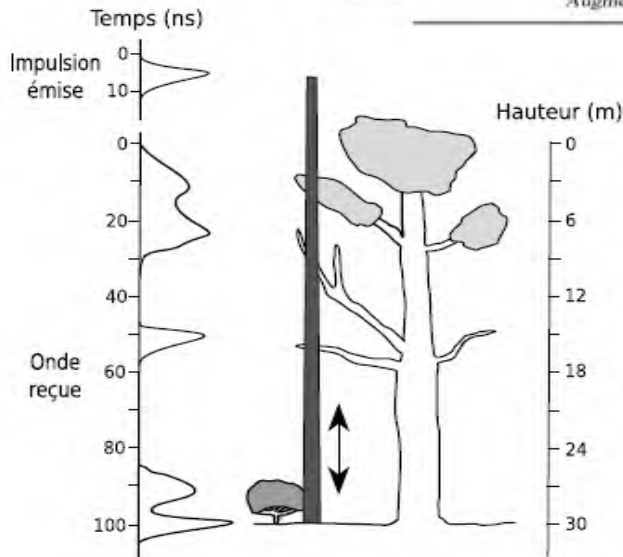
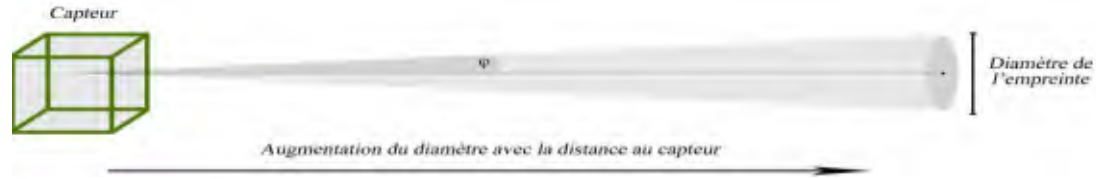
- Différentes plateformes



- Lidar topographique (PIR) vs bathymétrique (Vert)

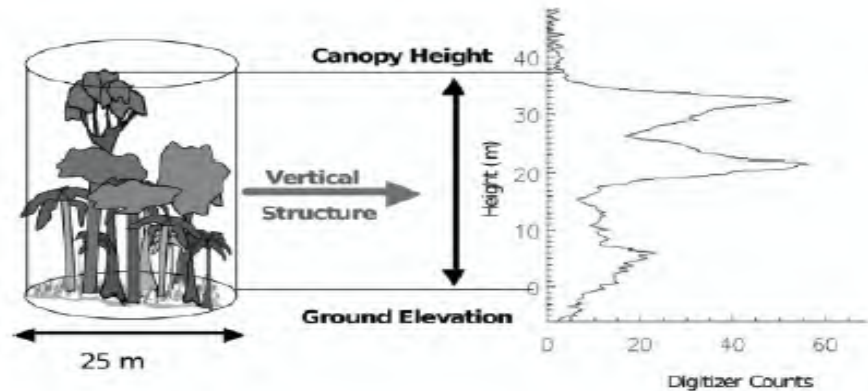


- Taille de l'empreinte : $f(\text{divergence du faisceau} + \text{distance capt-cible})$



LiDAR small footprint :

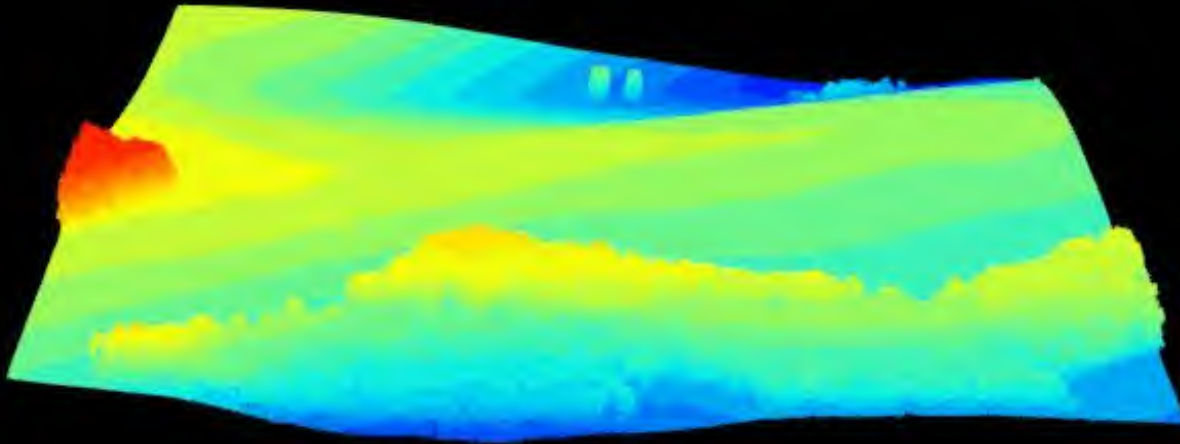
0,2 – 3 m Ø



LiDAR large footprint

10 – 70 m Ø

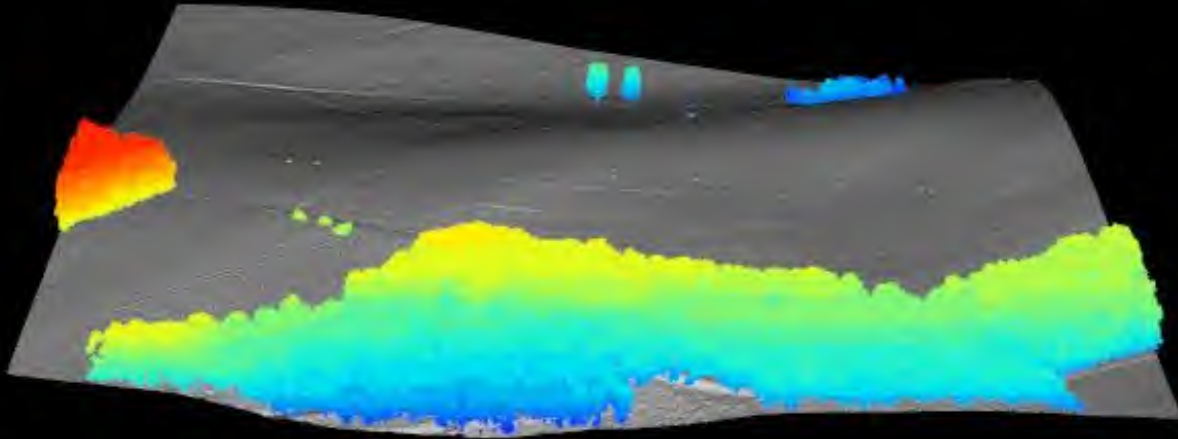
- Produits livrés : nuage de points



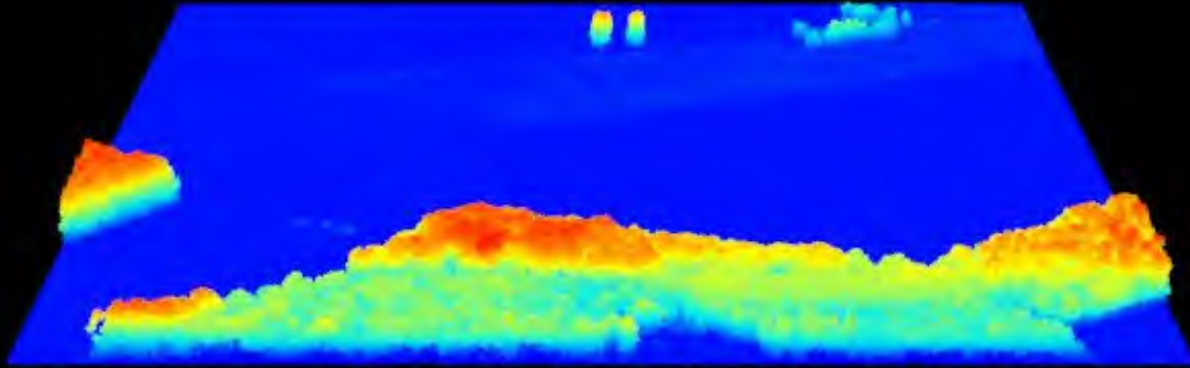
Source: SPW
LiDAR 2021-2022
Densité moyenne : 13,1 points/m²

Bolyn C. [2023] (<https://hdl.handle.net/2268/307728>)

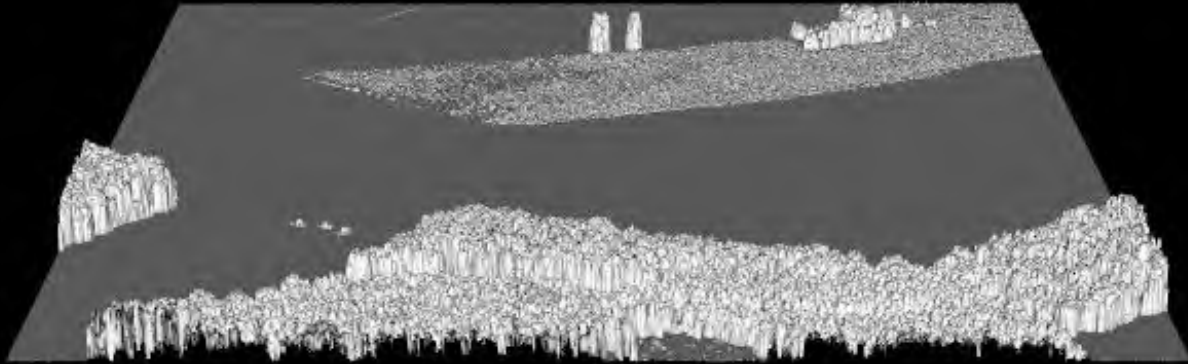
- Produits livrés : Modèle Numérique de Terrain (MNT) et Modèle Numérique de Surface (MNS)

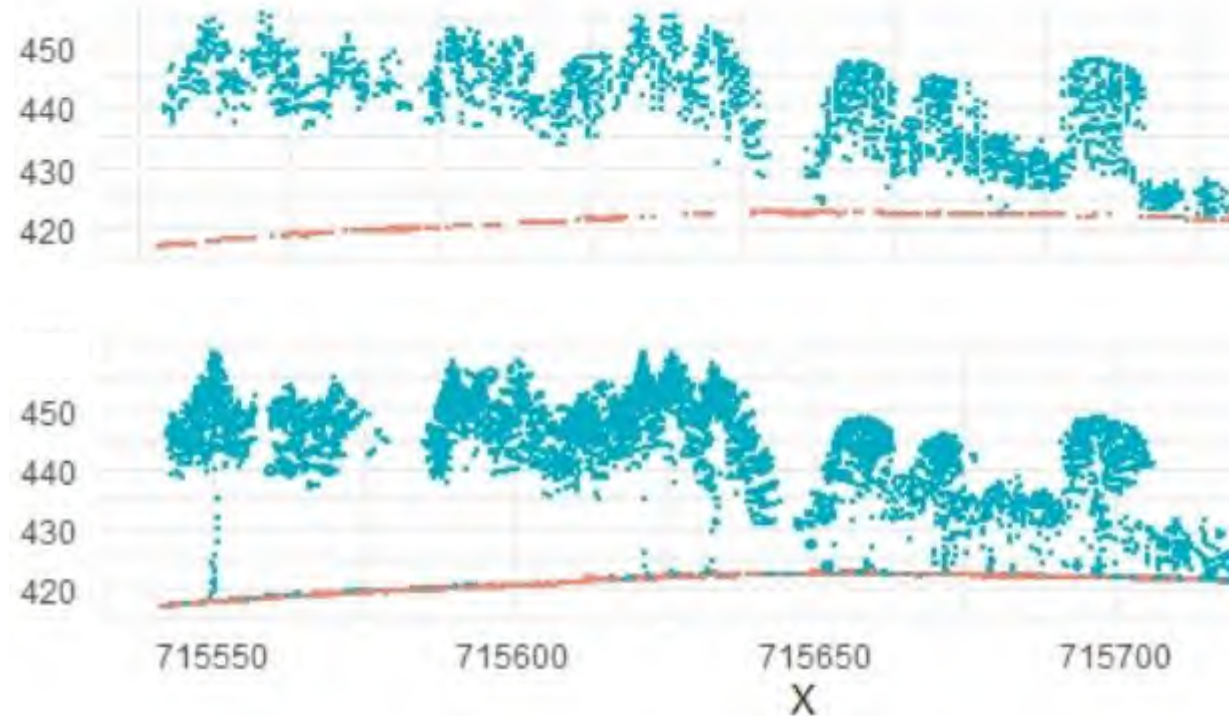


- Produits dérivés : Nuage de points normalisé (altitude → hauteur)



- Produits dérivés : Modèle Numérique de Hauteur (MNH) ou Modèle Numérique de Canopée (MNC)





Vol 2013-2014

coord. ref. : BD72 / Belgian Lambert 72
area : 18567.52 km²
points : 43.62 billion points
density : 2.3 points/m²
density : 1.5 pulses/m²
num. files : 1676

Vol 2021-2022

coord. ref. : ETRS89 / Belgian Lambert 2008
area : 17165.31 km²
points : 225.16 billion points
density : 13.1 points/m²
density : 10.2 pulses/m²
num. files : 17585

Précision altimétrique : 12 cm

- Modifications du relief
- Les cours d'eau
- Les arbres hors forêt
- Les forêts tempérées
- Les forêts tropicales
- Modélisation 3D des arbres
- Suivi des forêts à large échelle (GEDI)

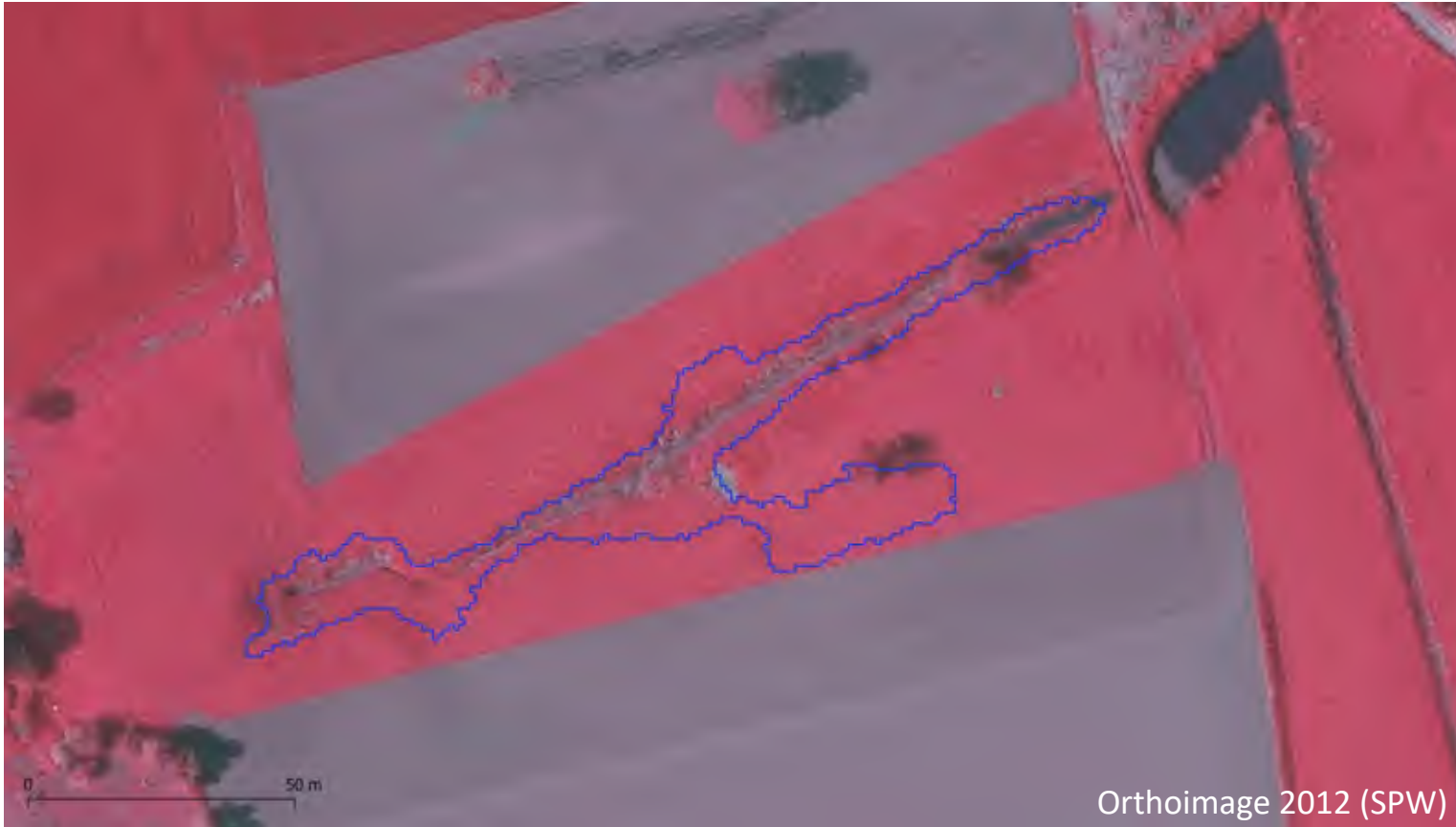
Modifications du relief



- Détection de remblaiements en zone naturelle
- Erosion liée aux pratiques agricoles



$MNT_{2021} - MNT_{2014}$ (rés 1 m)



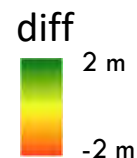
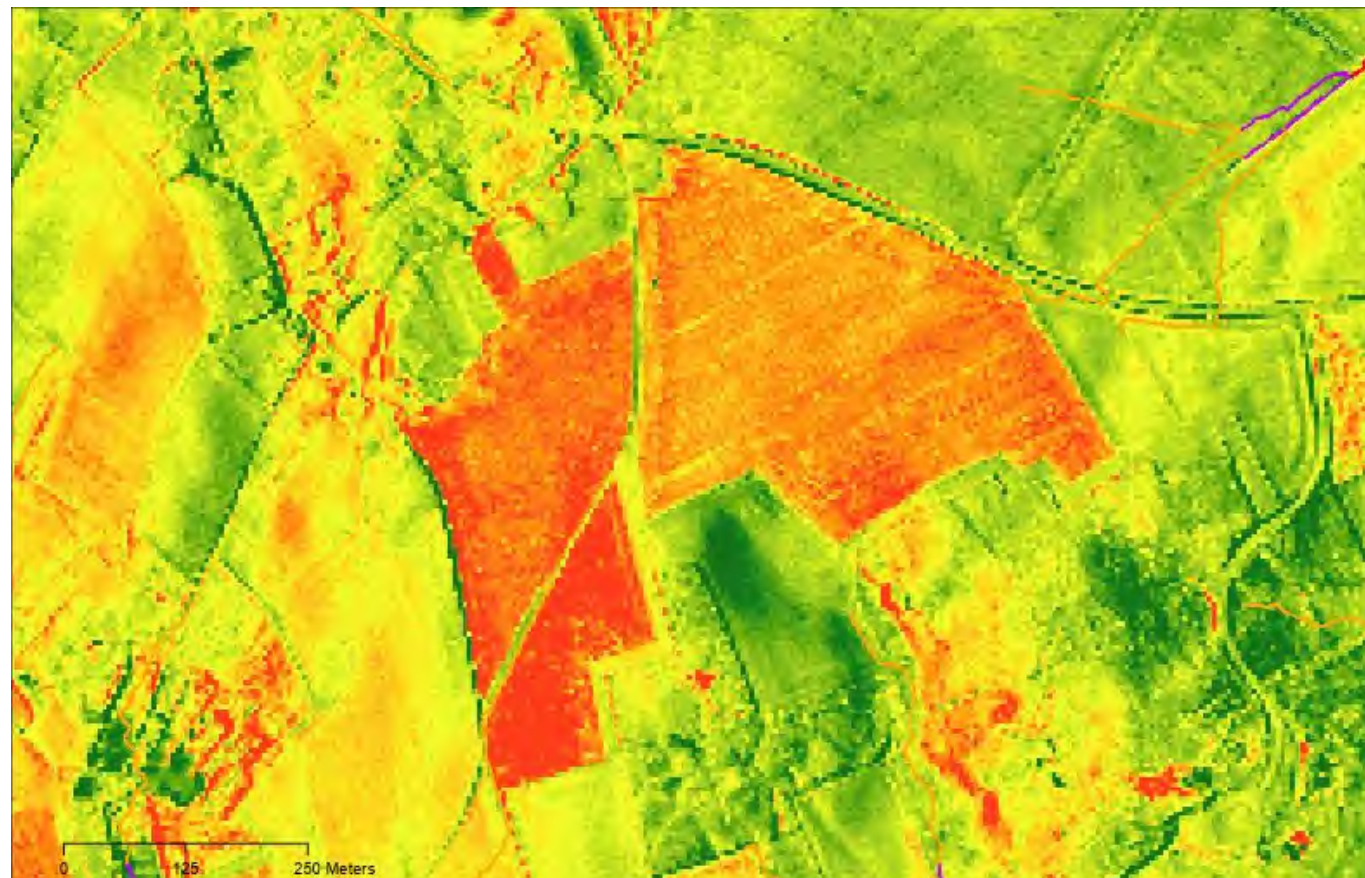


Orthoimage 2022 (SPW)



Erosion liée aux pratiques agricoles

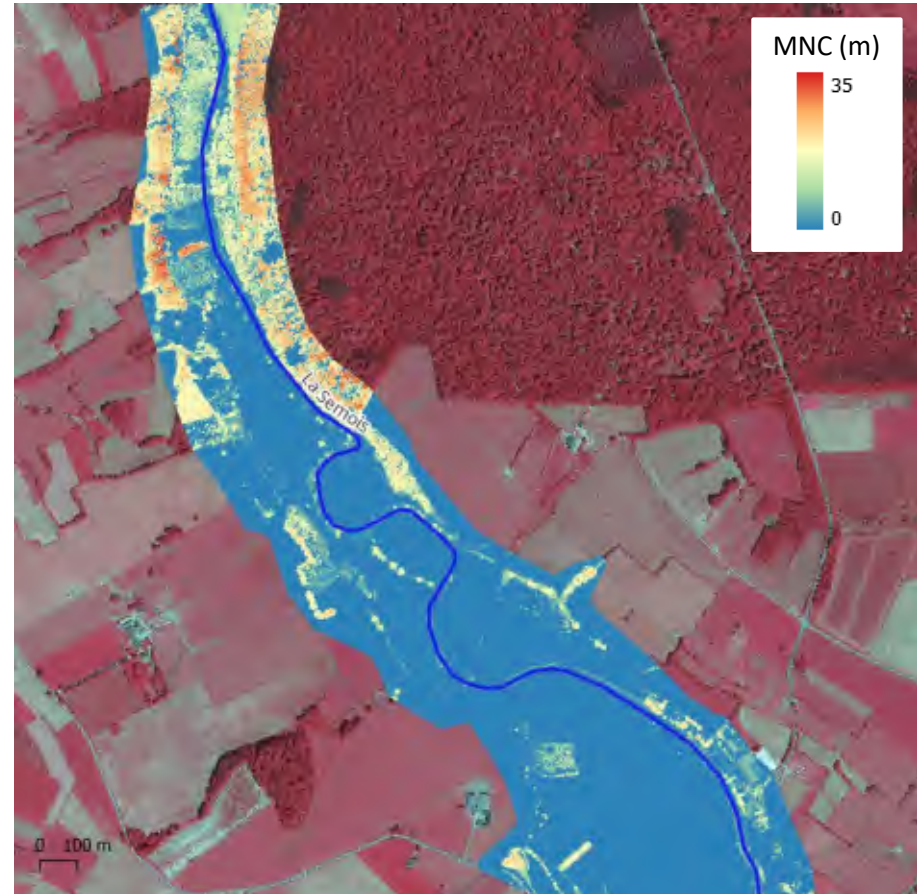
Pertes en sols : de 20 à 50 cm liées aux cultures sarclées de printemps (betterave et pomme de terre)

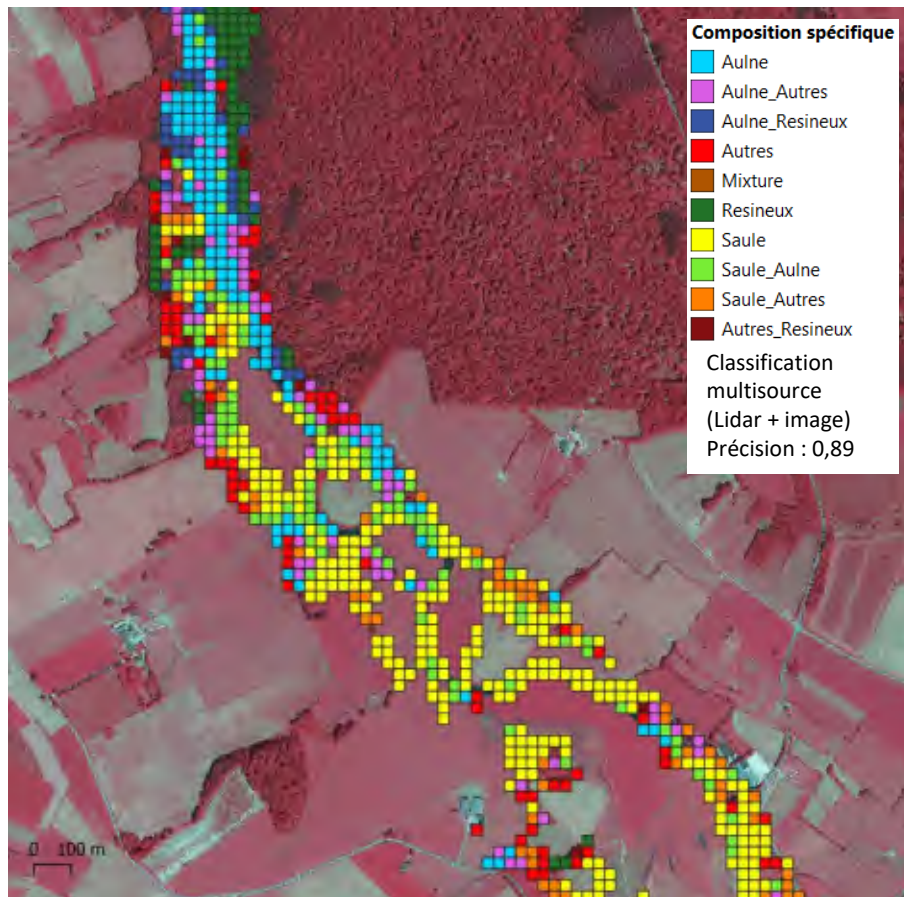


$MNT_{2021} - MNT_{2014}$ (rés 5 m)

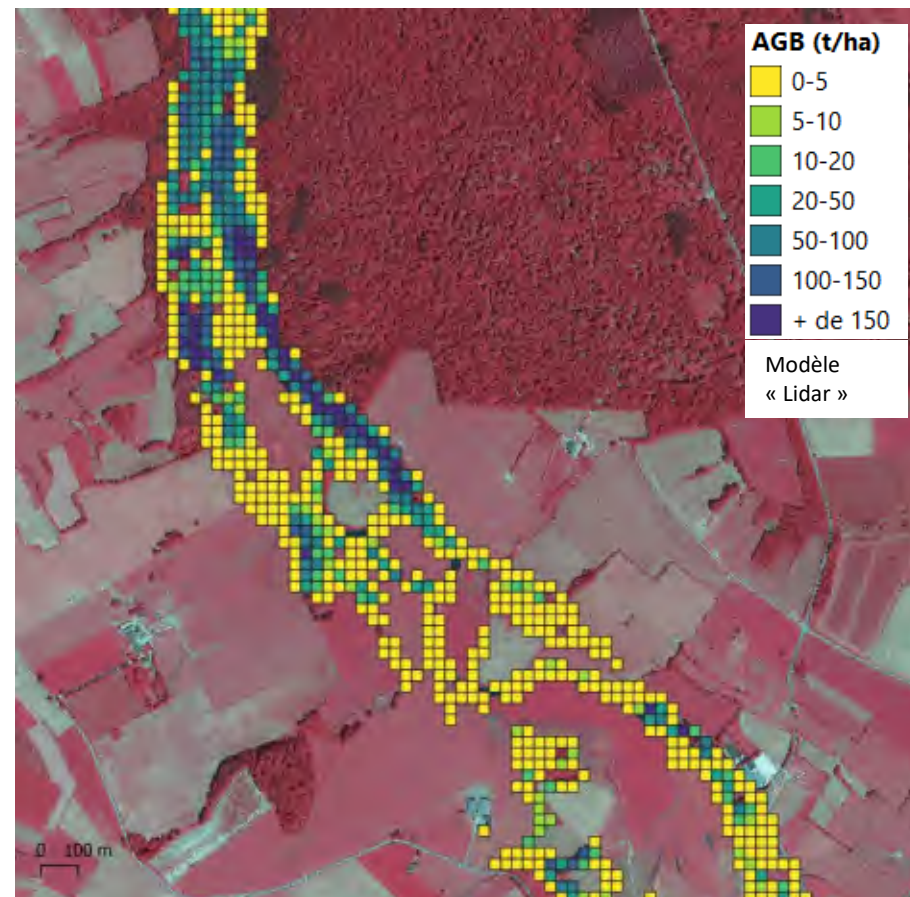
Les cours d'eau







Composition de la forêt riveraine



Biomasse aérienne



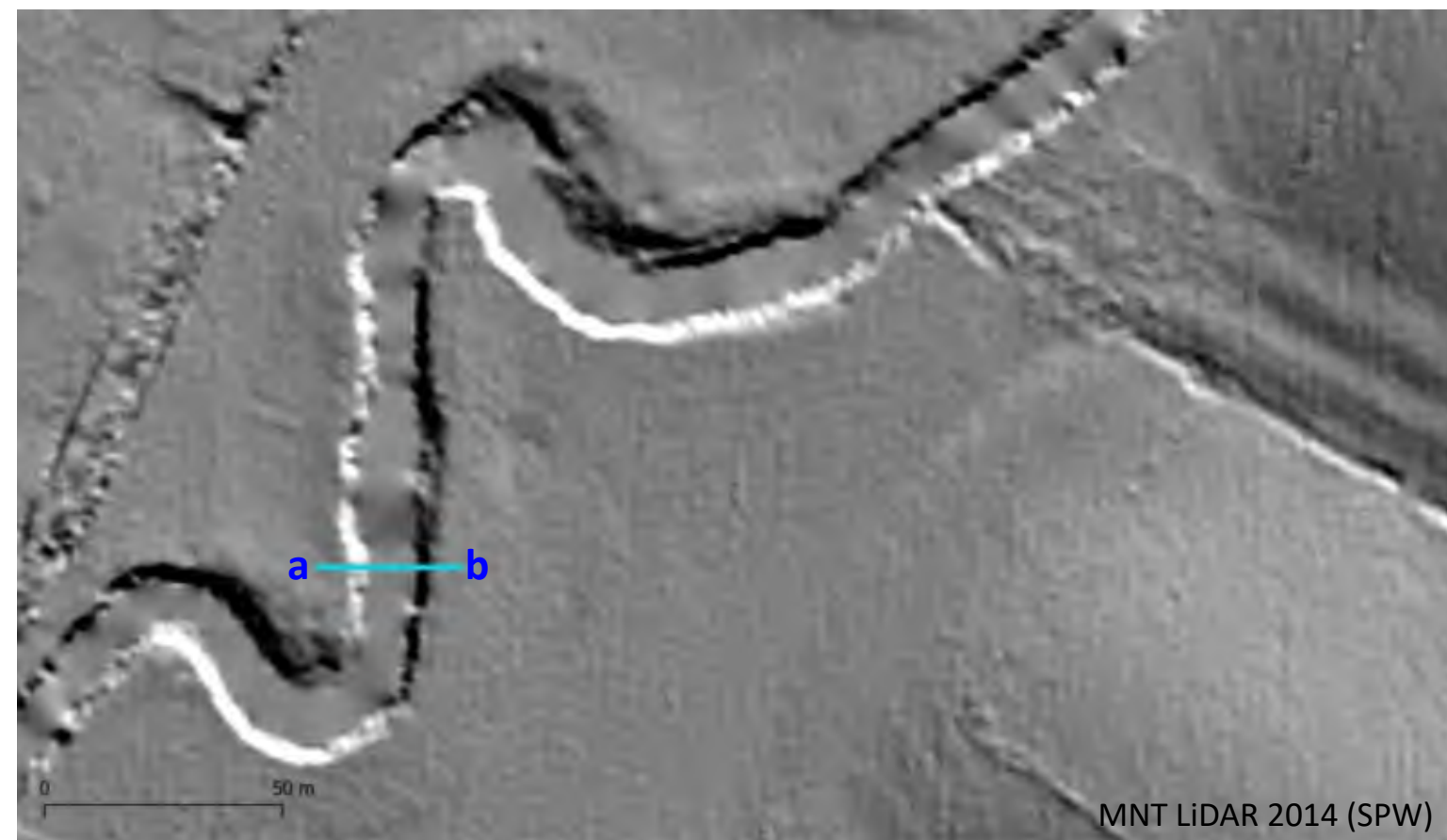
Erosion des berges



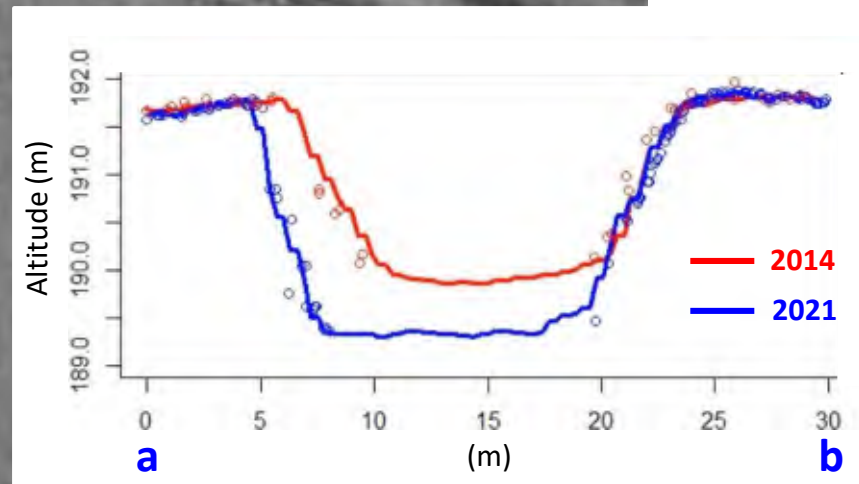
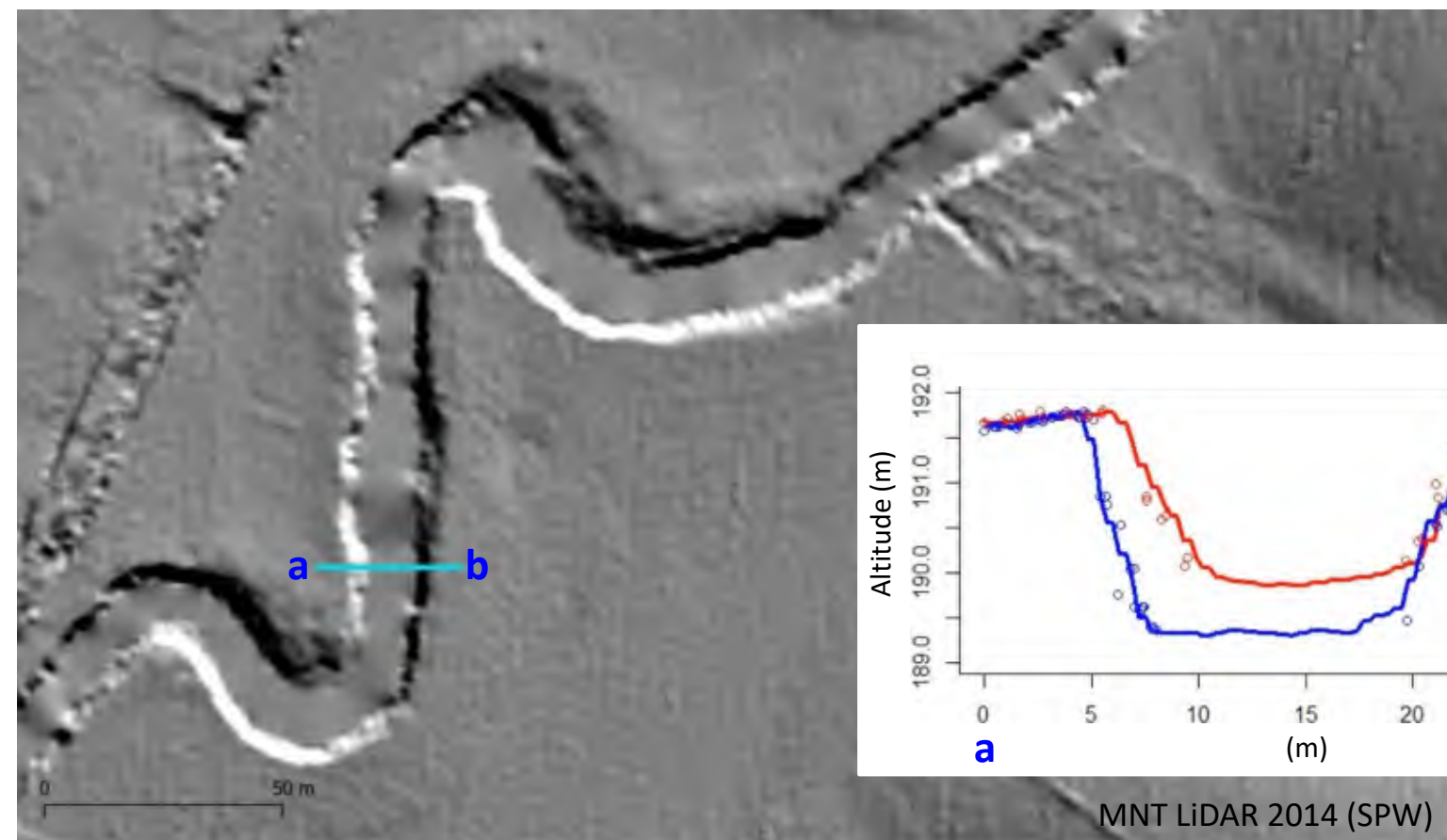
MNT LiDAR 2021 (SPW)

Erosion des berges

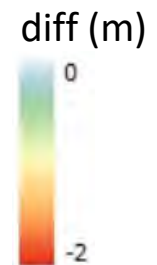
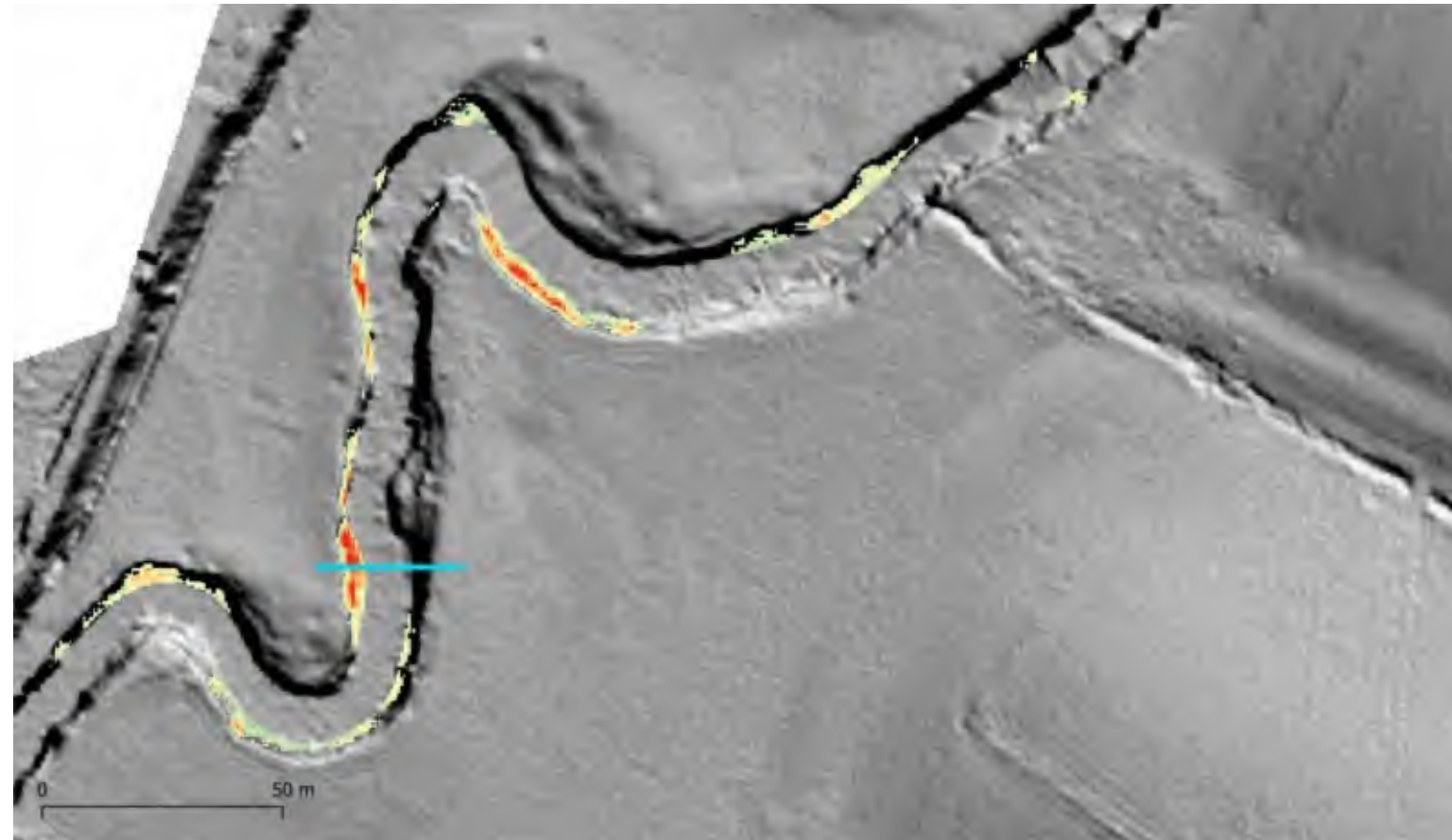
Hyulenbroeck L. [2024]



Erosion des berges



MNT LiDAR 2014 (SPW)



Erosion des berges : soustraction des MNT + seuillage + filtre morphologique

Hyulenbroeck L. [2024]

Les arbres hors forêt



+





Orthoimage 2012 (SPW)



MNC (rés. 1 m)

Bolyn C. [2023] (<https://hdl.handle.net/2268/307728>)



Seuillage hauteur (> 1m), seuillage NDVI (végét <> bâti)

Bolyn C. [2023] (<https://hdl.handle.net/2268/307728>)



Surface < 0,5 ha et largeur < 20 m

Bolyn C. [2023] (<https://hdl.handle.net/2268/307728>)



Orthoimage 2022 (SPW)



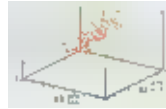
Les forêts tempérées



+



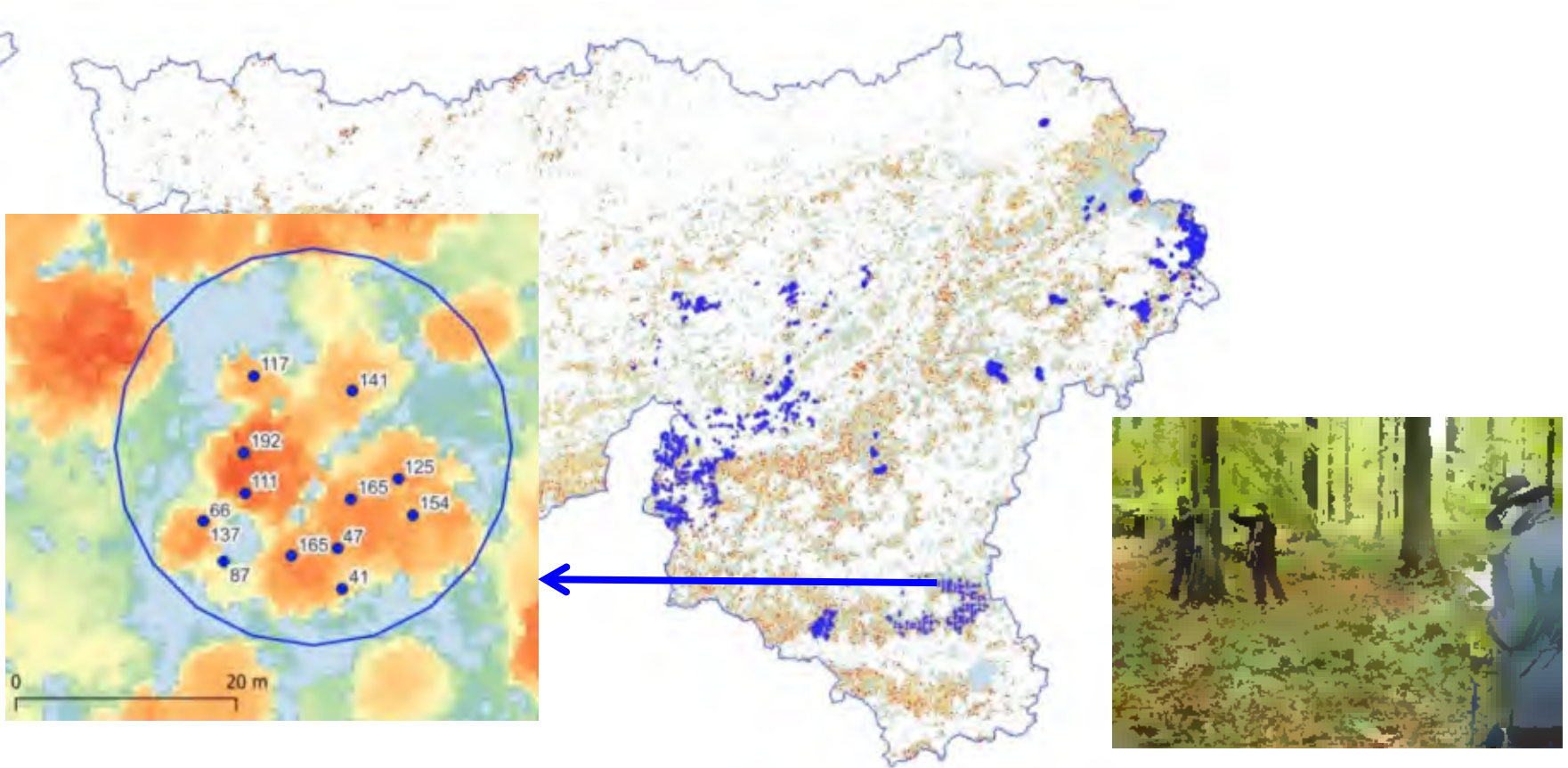
+



- Prédiction du volume de bois sur pied

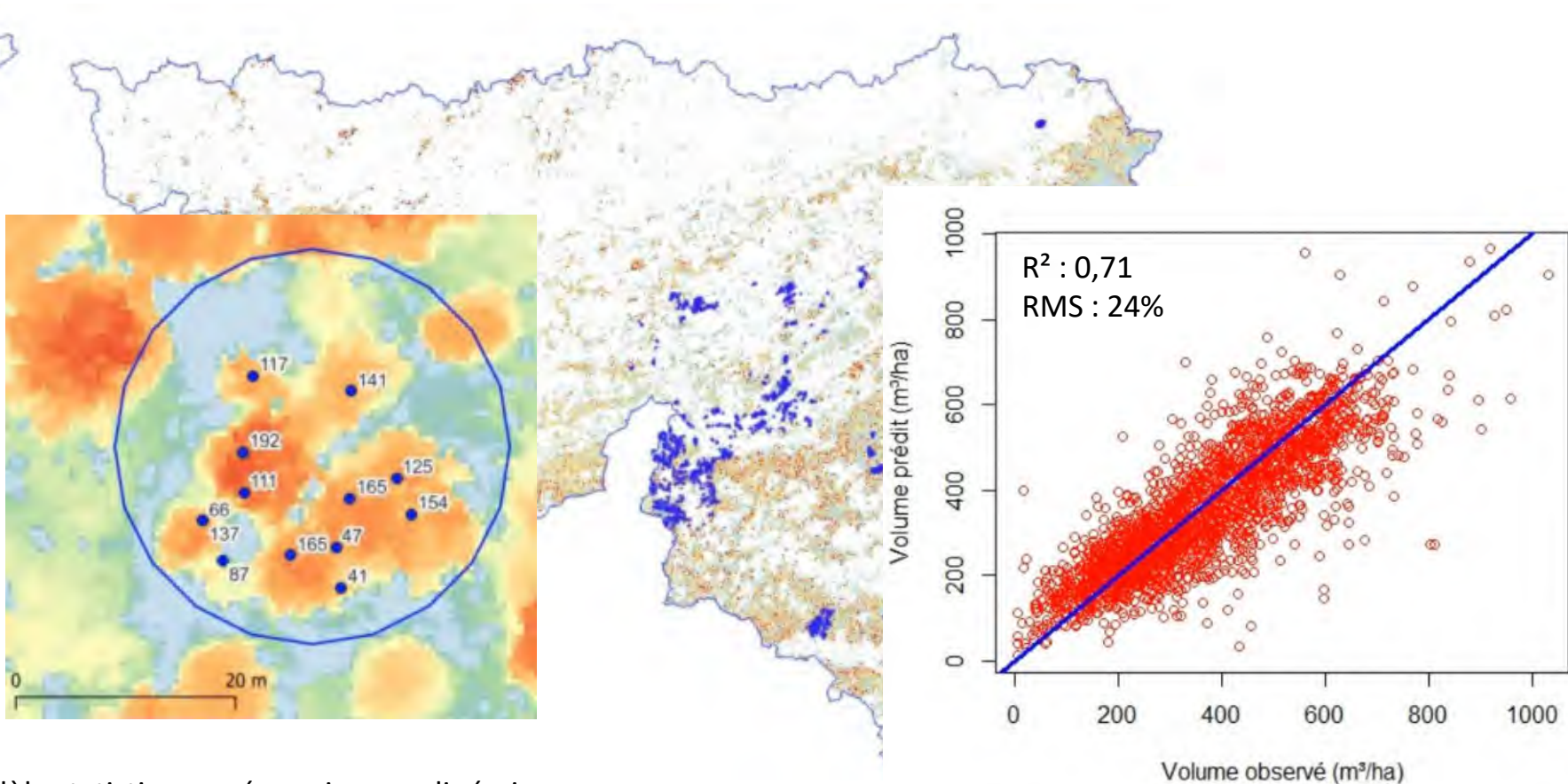


Prédiction du volume de bois sur pied



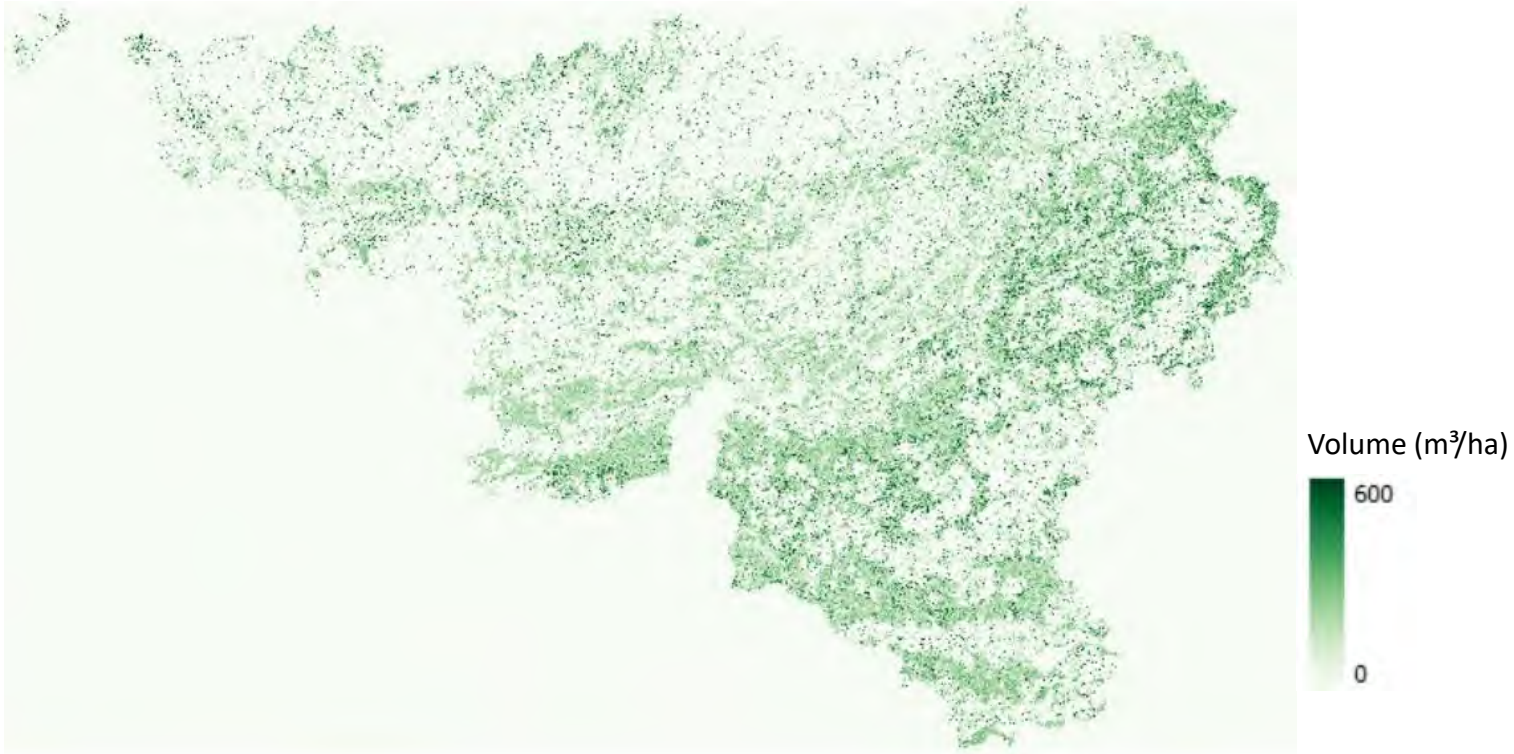
Placettes de mesures sur le terrain (n=2800) – surface : 0,1 ha

Prédiction du volume de bois sur pied



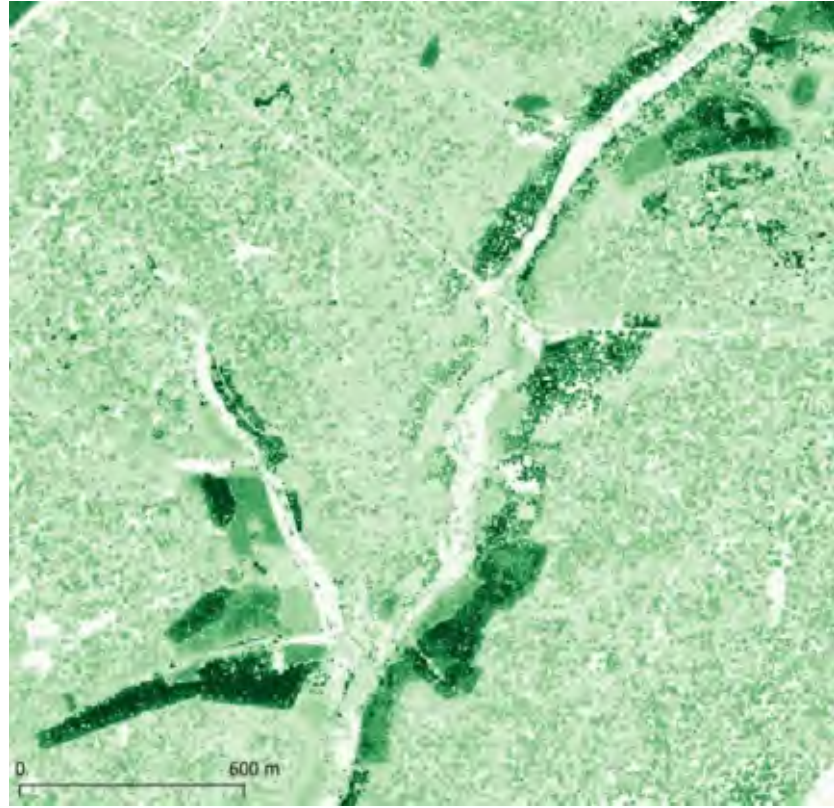
Modèle statistique – régression non linéaire

Prédiction du volume de bois sur pied



Modèle statistique - prédiction du volume de bois /ha – pixels de 0,1 ha

Prédiction du volume de bois sur pied



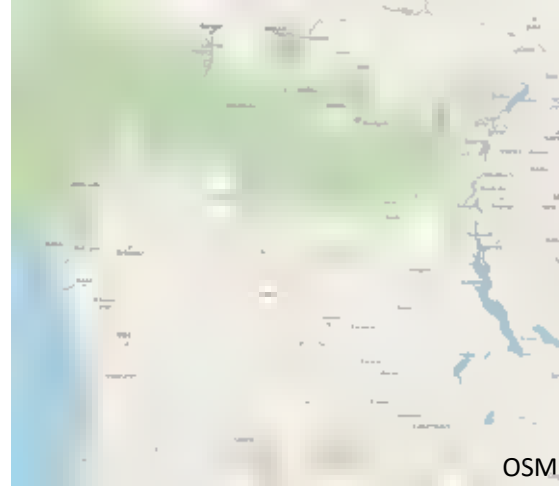
Modèle statistique - prédiction du volume de bois /ha – pixels de 0,1 ha

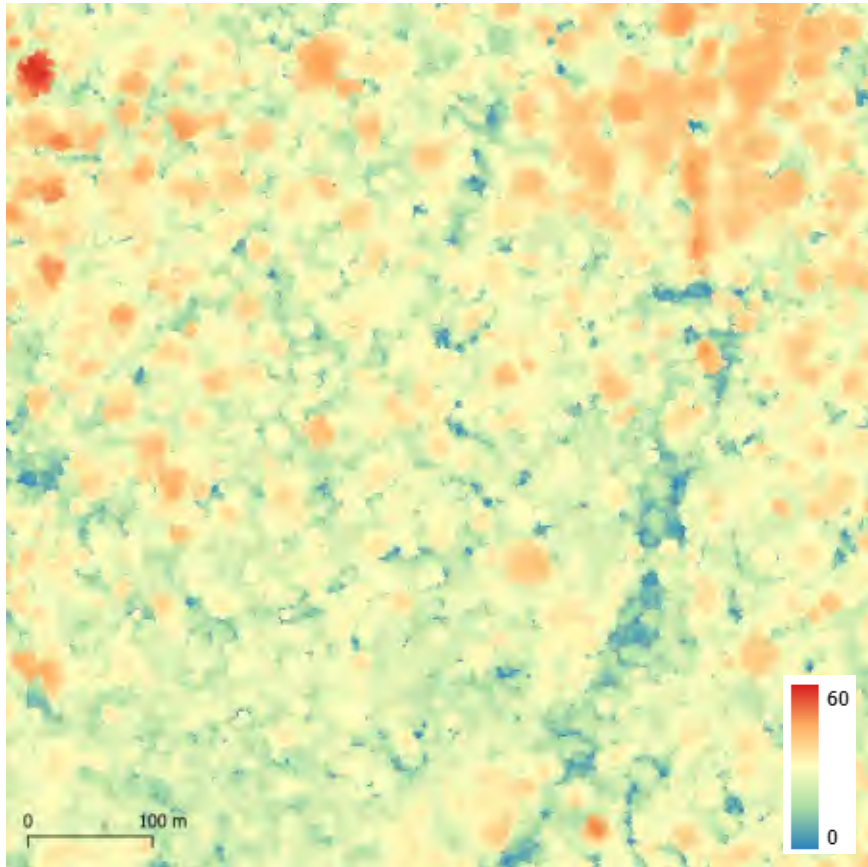
Les forêts tropicales



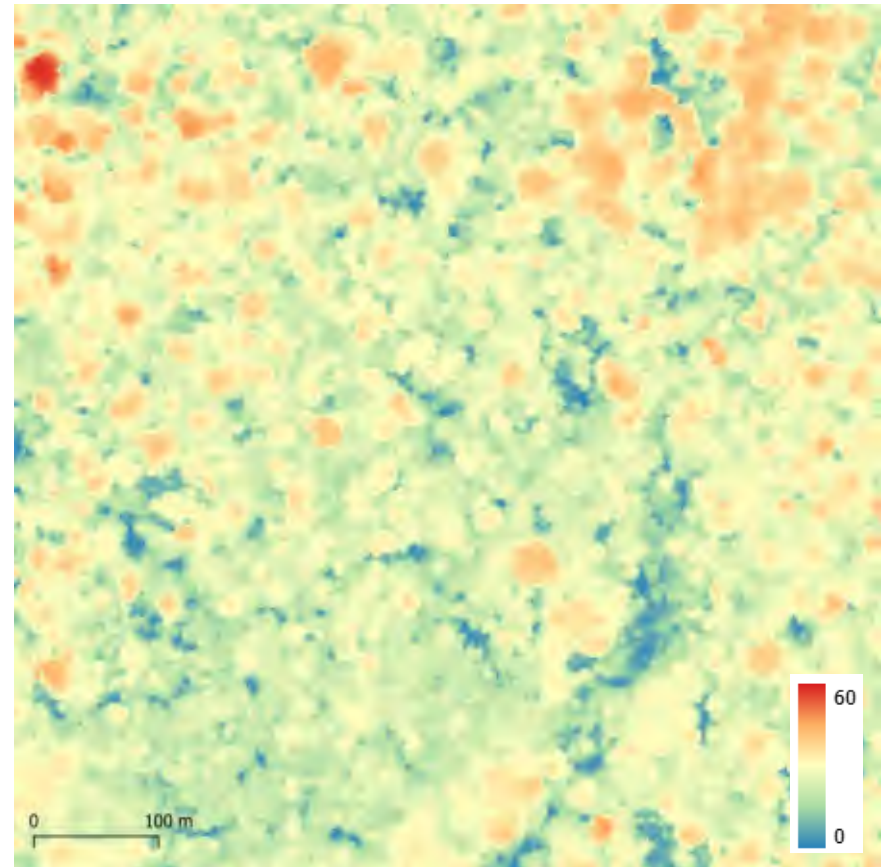


Google Earth



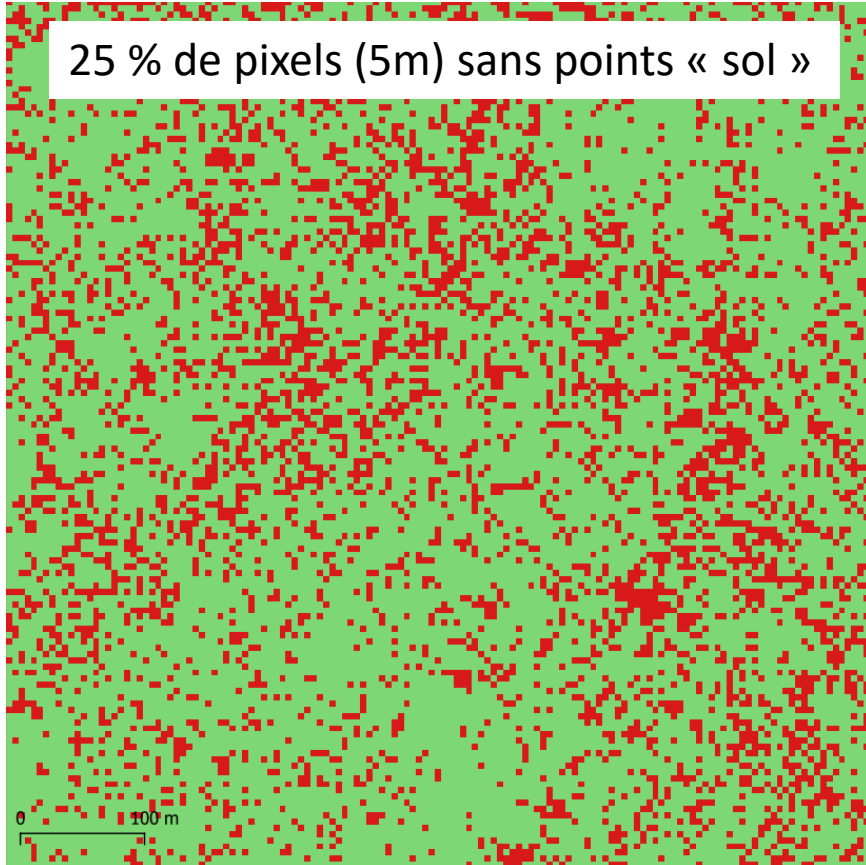


MNC 2014 – ALS (7 pts/m²)



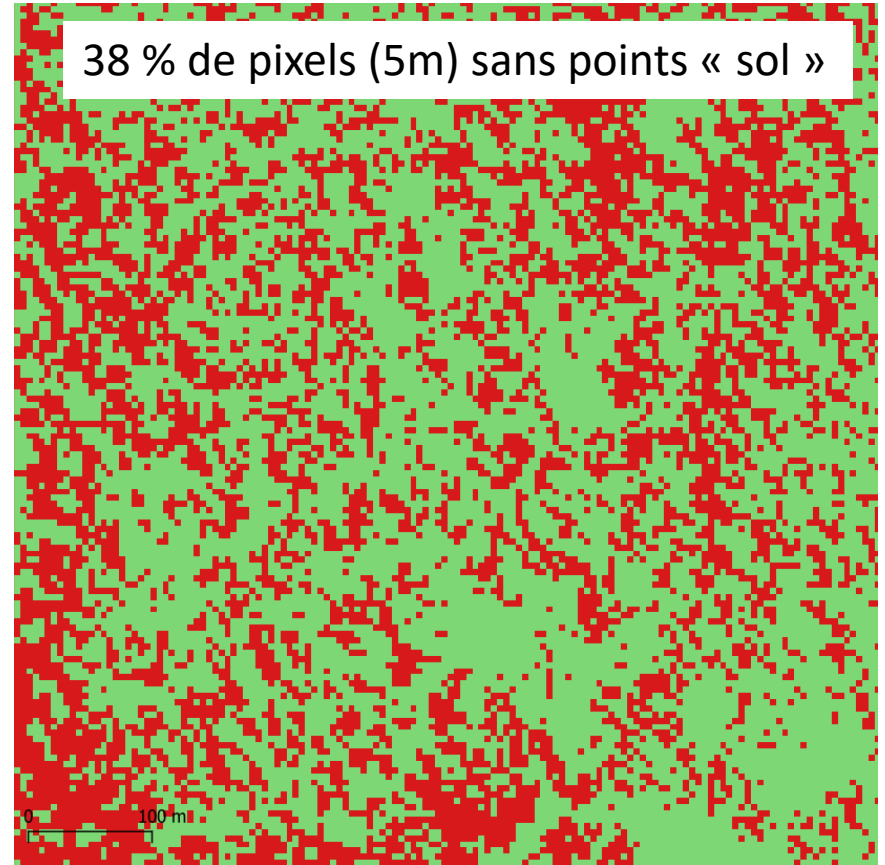
MNC 2023 – ULS (300 pts/m²)

25 % de pixels (5m) sans points « sol »



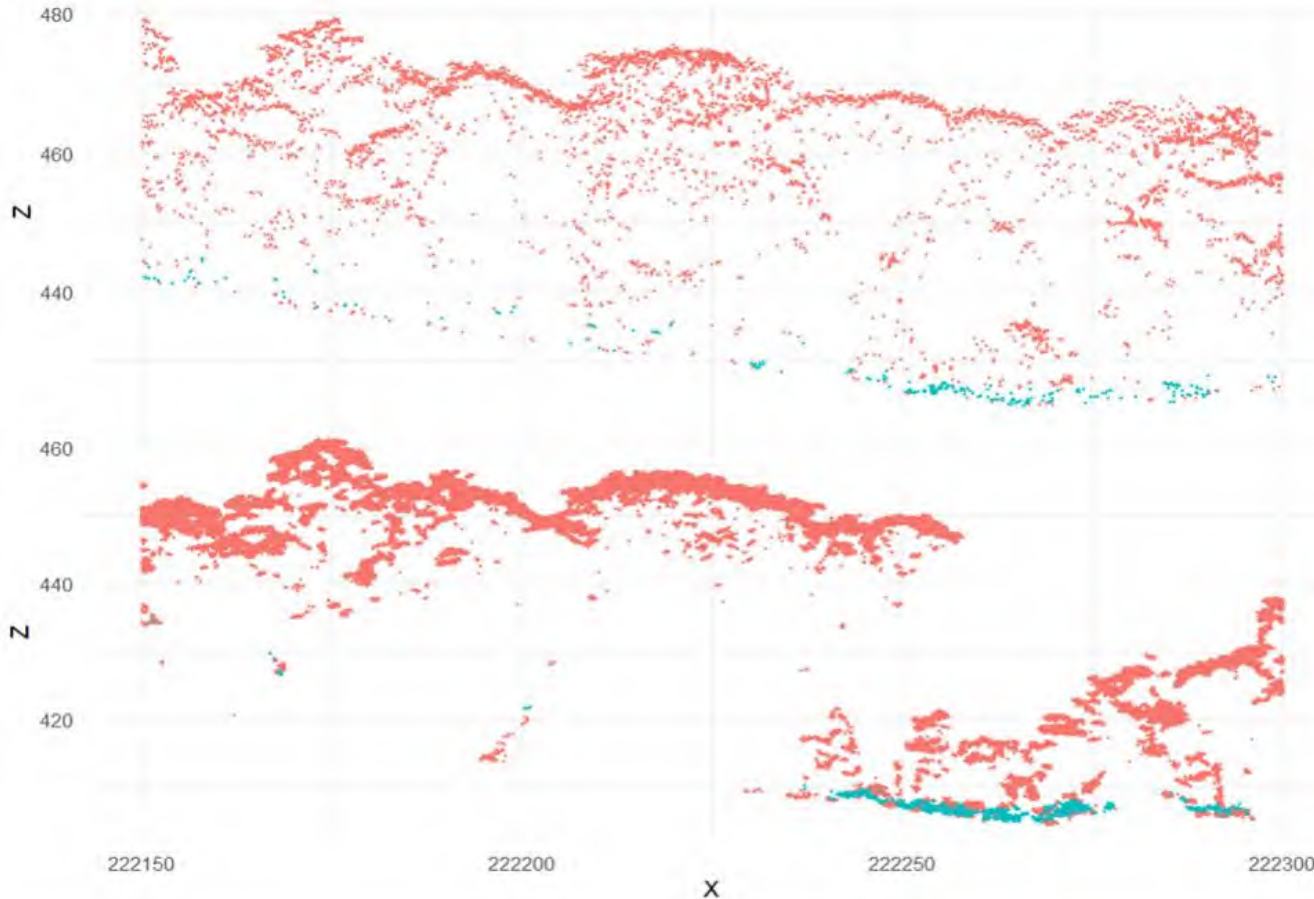
ALS 2014 (7 pts/m²)

38 % de pixels (5m) sans points « sol »



ULS 2023 (300 pts/m²)

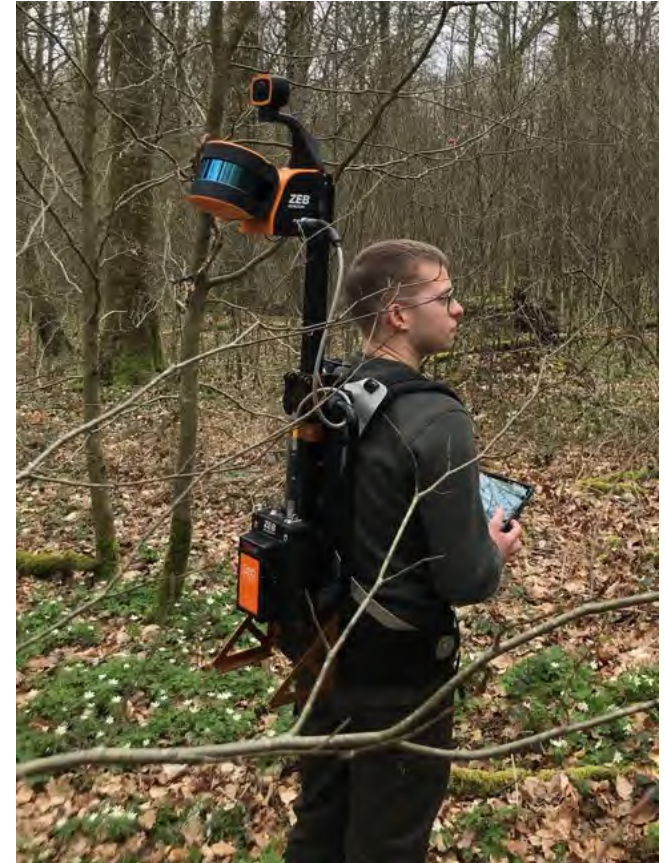




ALS 2014 - 7 pts/m²

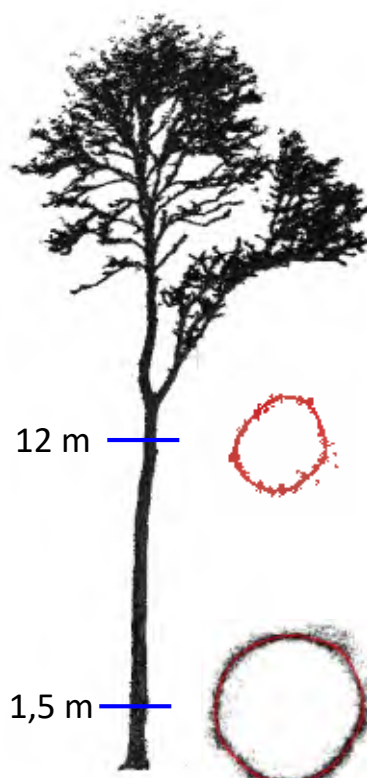
ULS 2023 - 300 pts/m²

Modélisation 3D des arbres





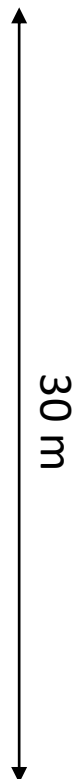
TLS



MLS



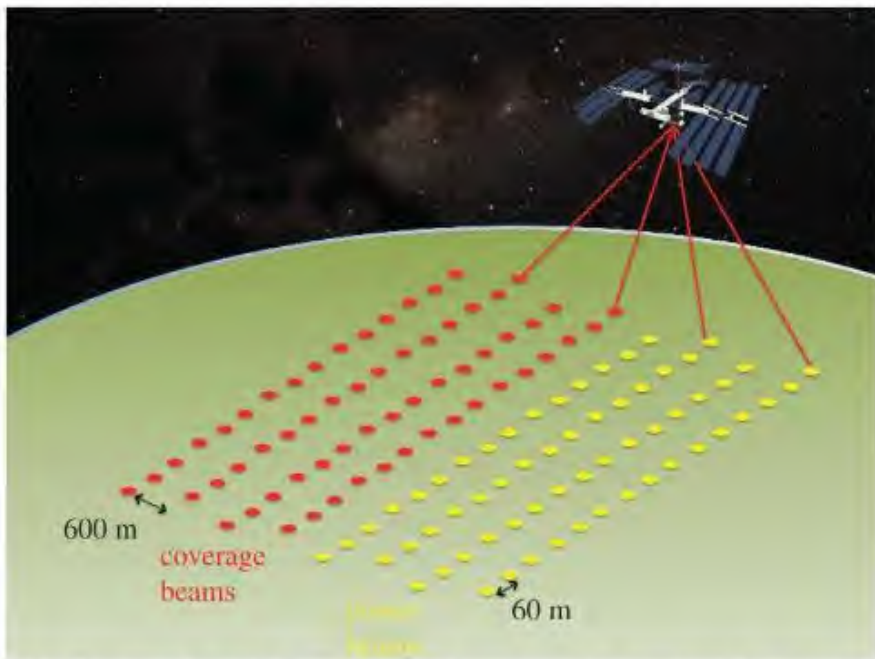
Modèle QSM (MLS)



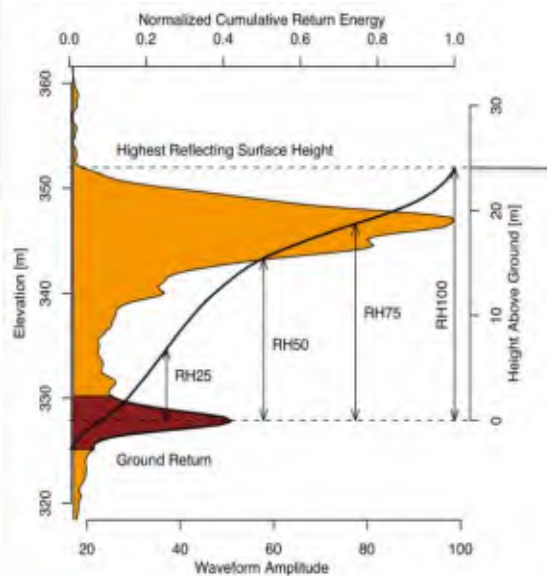
30 m

Le suivi des forêts à large échelle (GEDI)

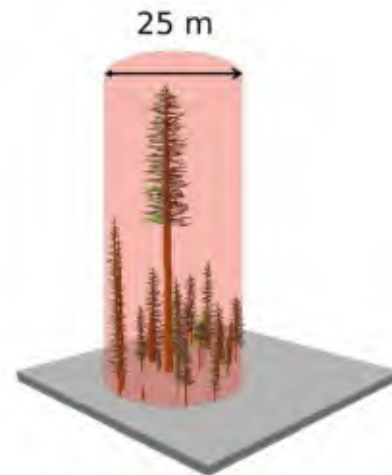




a) Illustration of GEDI sampling on the ground (source: Royal Society Open Science)



gedi.umd.edu



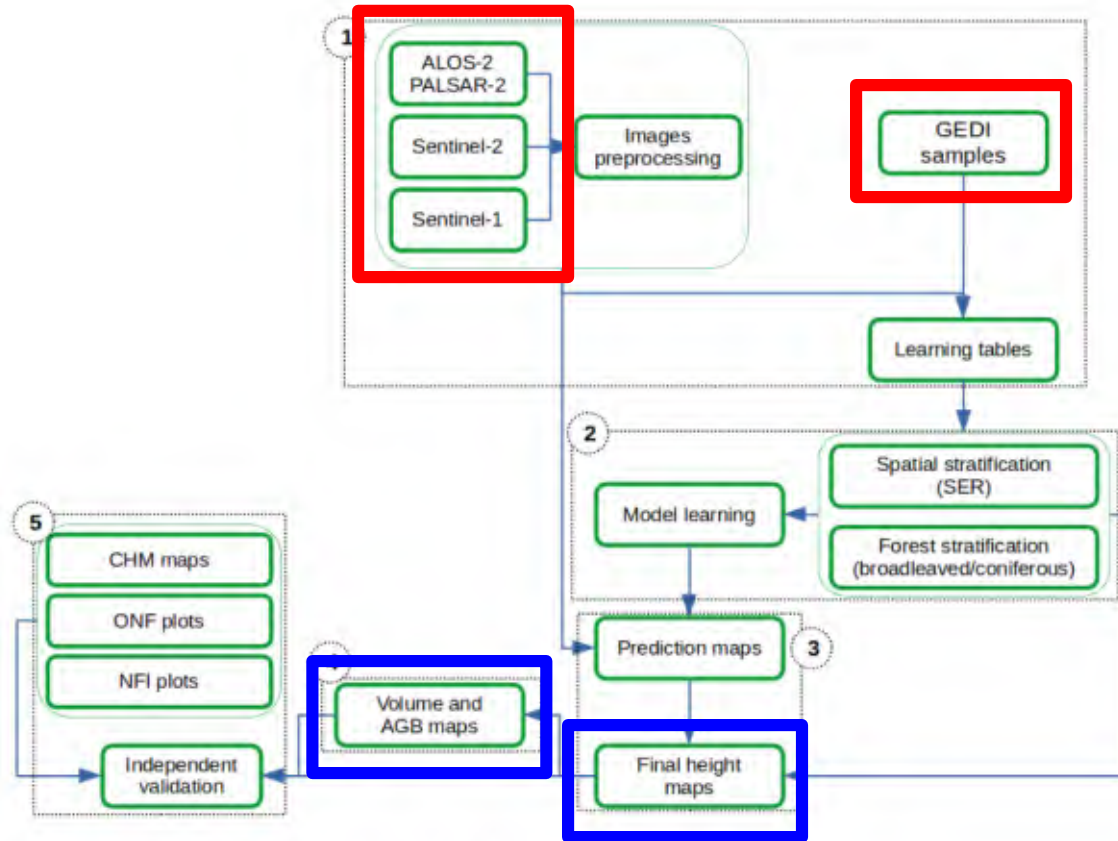


Figure 4. Flowchart of the height estimation method developed in this study.

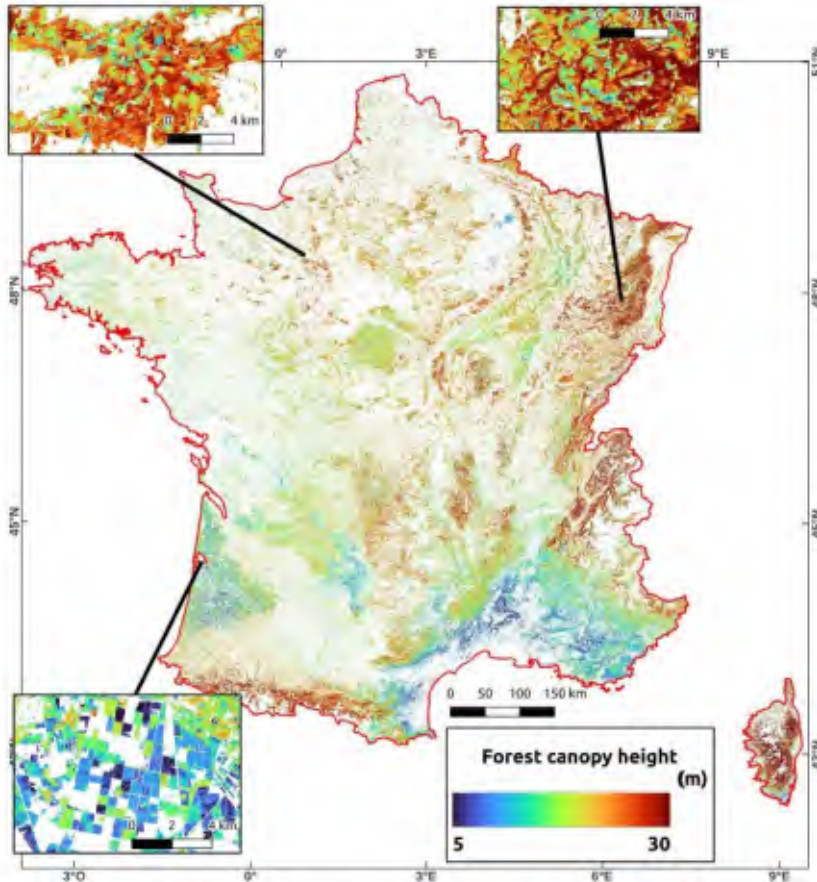


Figure 5. France canopy height map at 10m spatial resolution, produced using the method developed in this study.

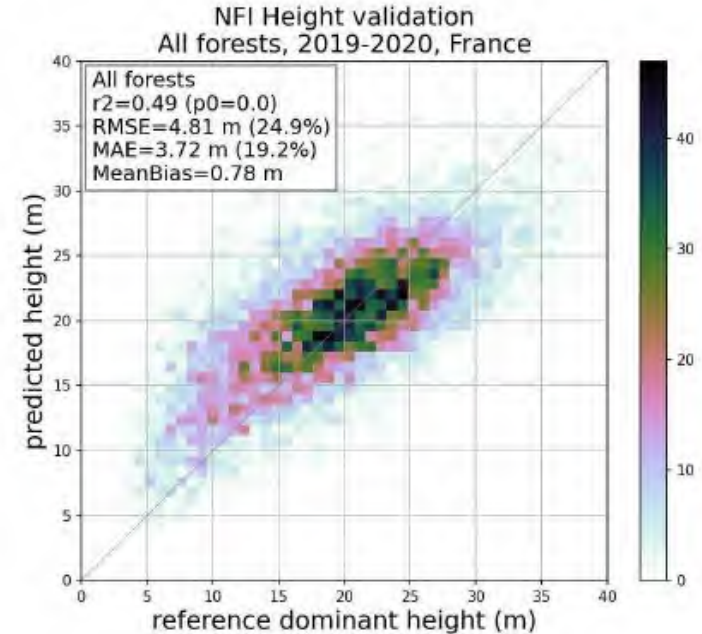


Figure 6. Validation of height estimations on NFI plots throughout France.



Merci pour votre attention ...