



Recovery Observatory Haiti

Rivière Froide (Cold River), Morne l'Hopital
Février 2010 - déclenché par un séisme



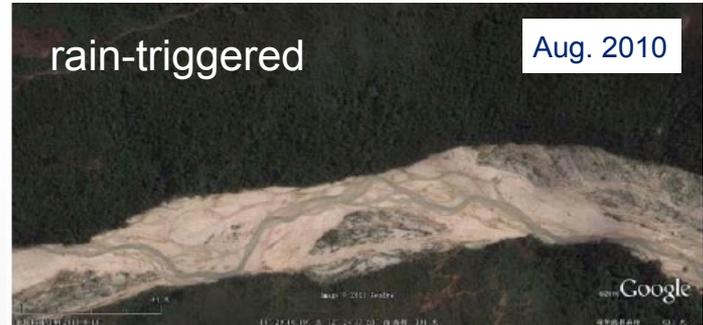
Cartographie Automatique de Glissements de Terrain à partir d'images optiques VHR

CNRS-EOST – Univ. Strasbourg
A. Déprez, O. Marc, E. Stell, J.-P. Malet



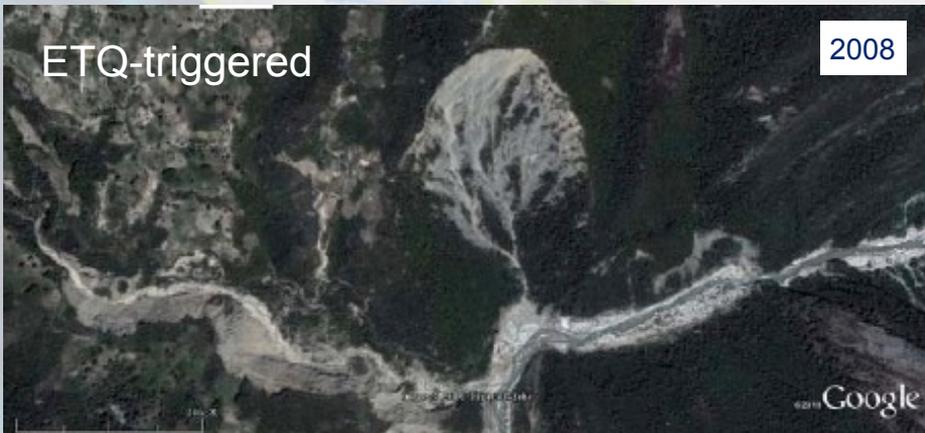


- Superficiels : 2 m d'épaisseur max
- Petits (en surface) : $1.10^3 - 1.10^5 \text{ m}^2$
- Localisés majoritairement à proximité des thalwegs
- Re-végétalisation rapide après le déclenchement
- Effets cumulatifs de plusieurs évènements déclenchants (séisme, fortes pluies):
 - Séquences de glissements à identifier dans les inventaires



ETQ-triggered

2008



2010



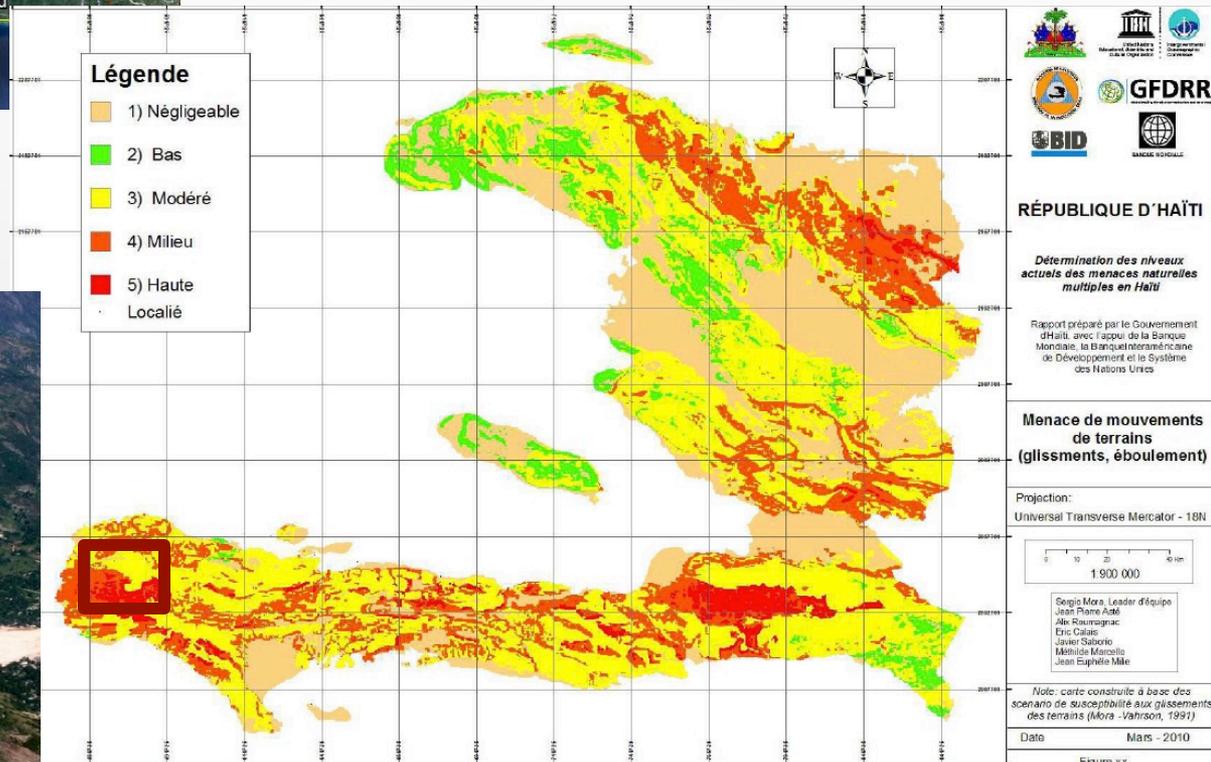


Carte de susceptibilité aux glissements de terrain

Topographie = premier facteurs de contrôle

Carte créée sans inventaire de glissements

Paysage post-Matthews



Macrozonation of slope failure hazard (NATHAT, 2010)



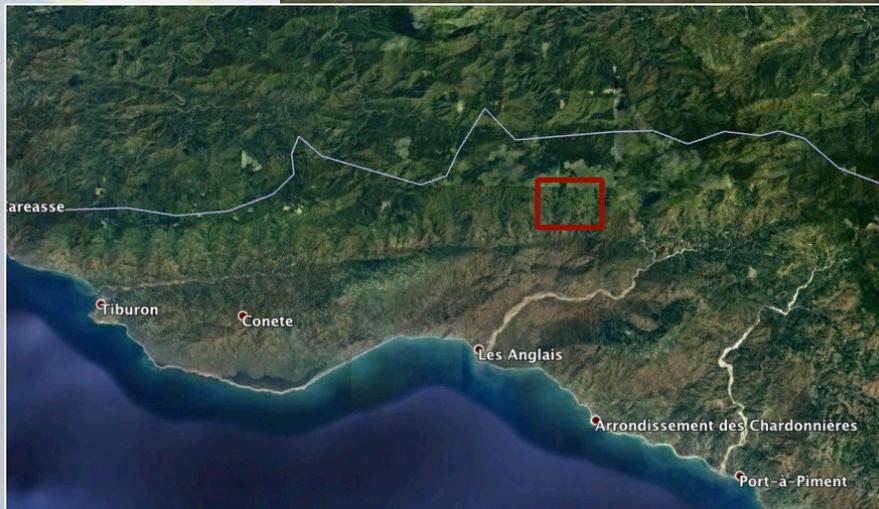
Paysage complexe pour une cartographie automatique

sol nus
ou champs
ou déforestation

glissement de terrain

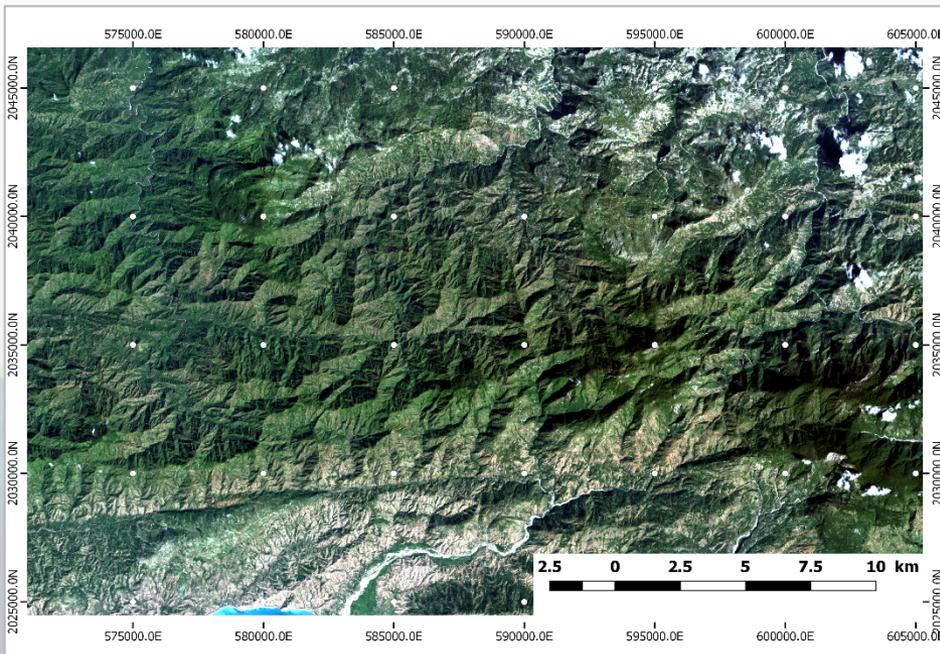


effet de des variations d'illumination, ombrages

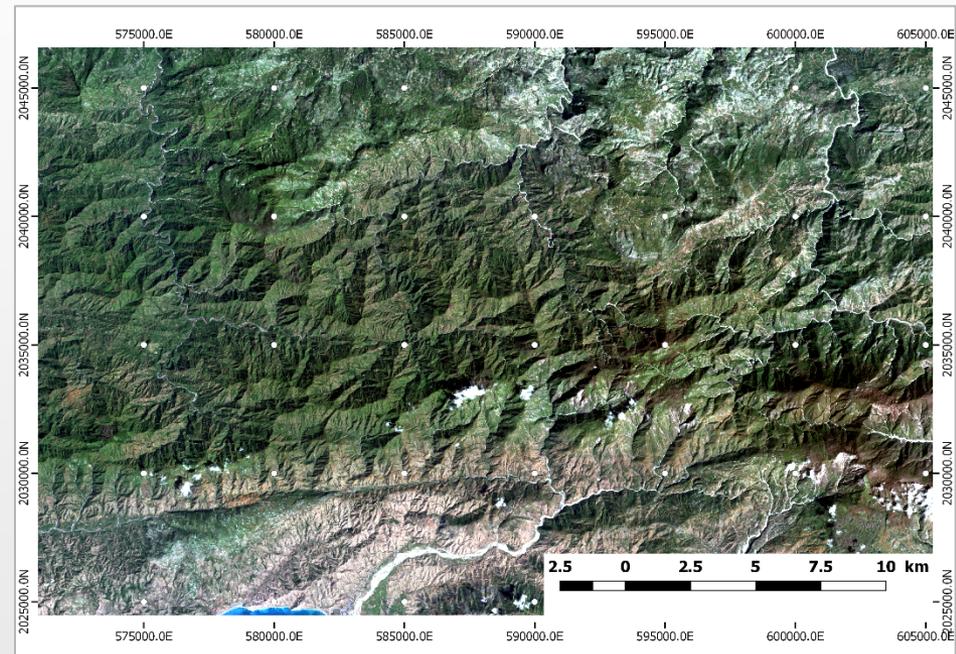


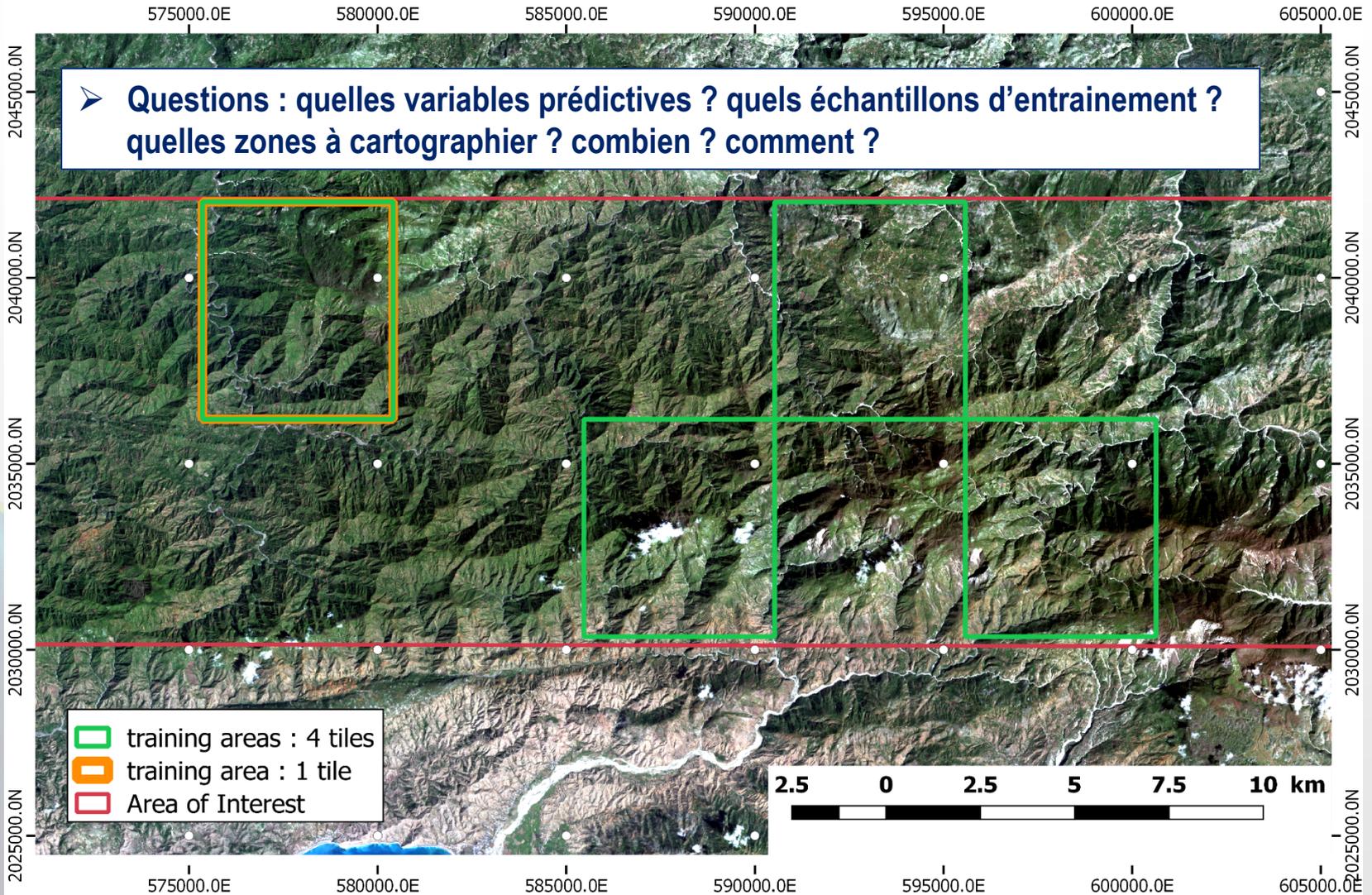


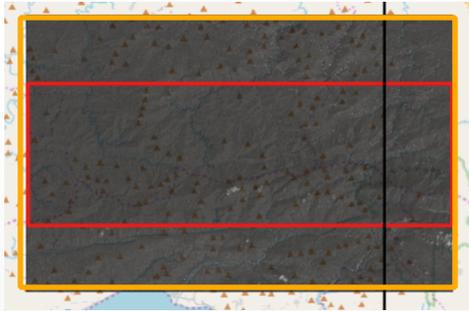
Spot 6 pre-Matthews 2016/04/14 (1.5m)



Spot 7 post-Matthews 2017/04/04 (1.5m)







Orange : inventaire géomorphologique
Rouge : test inventaire « satellite »

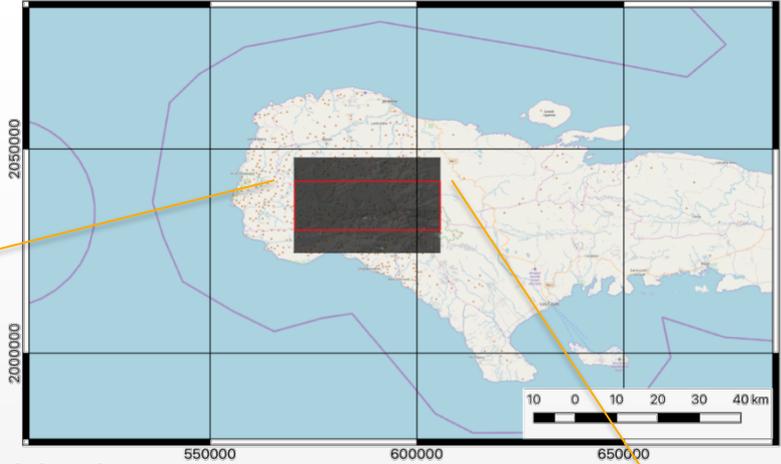
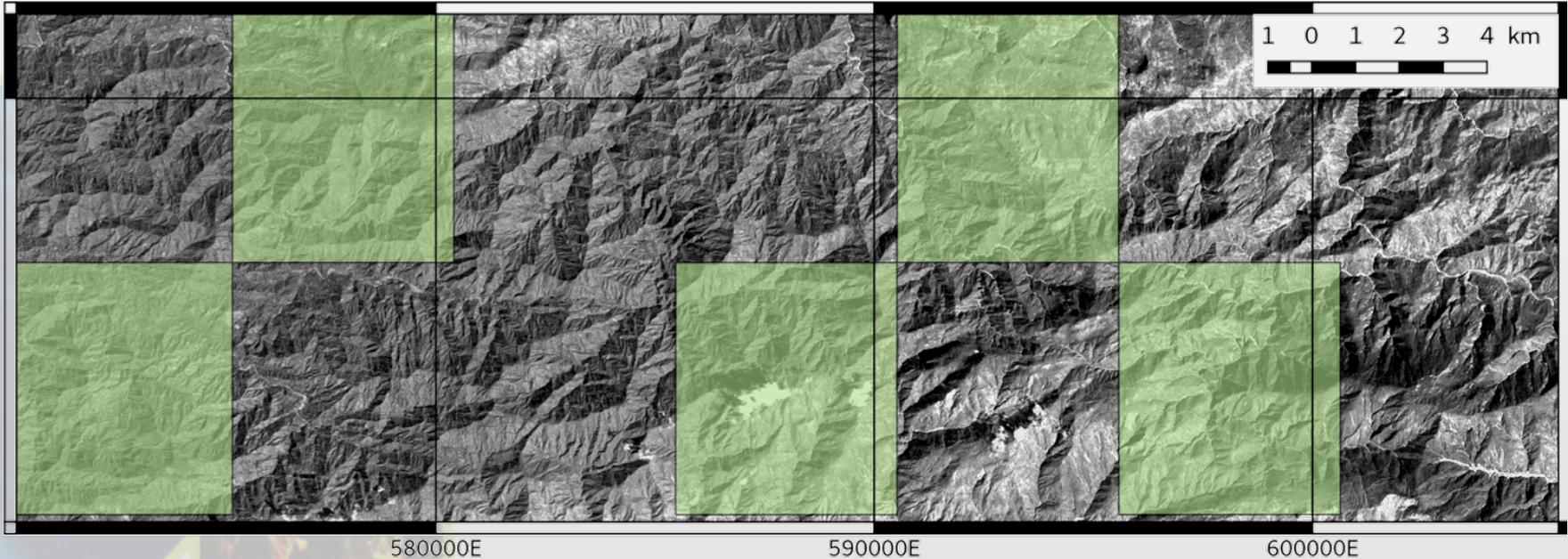
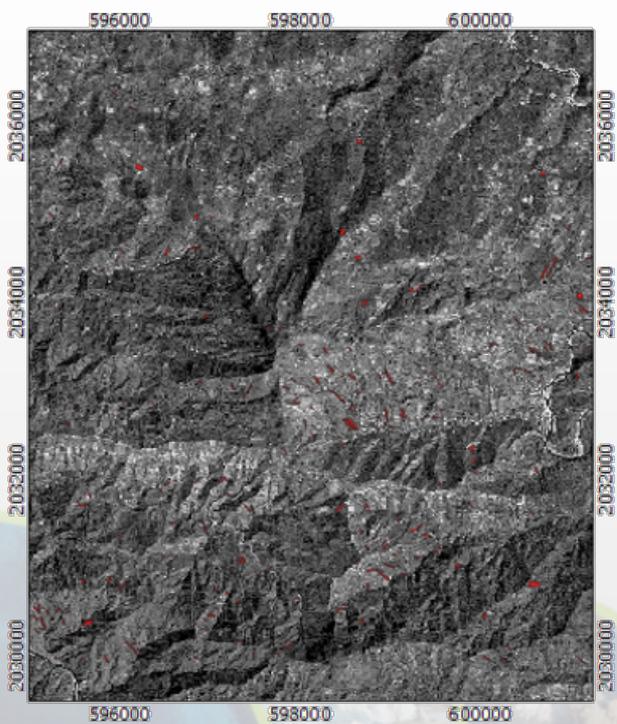


Image Spot 7 (panchro) – post-cyclone Matthews

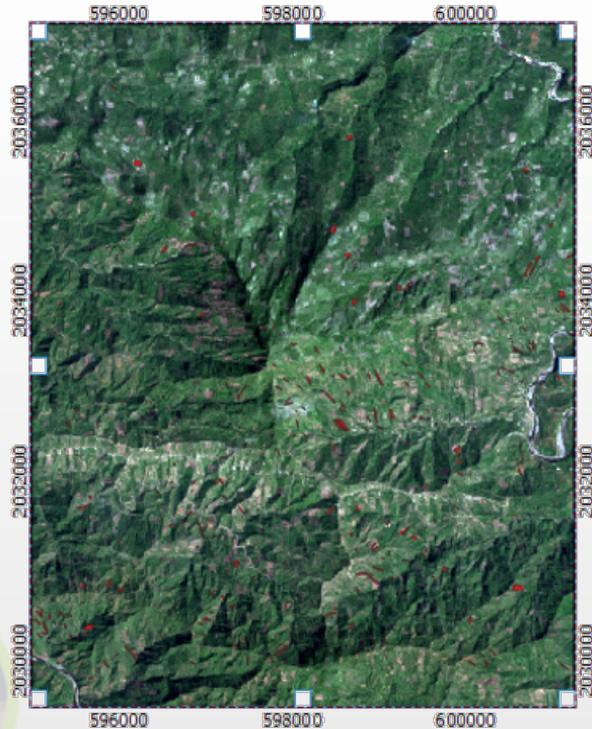




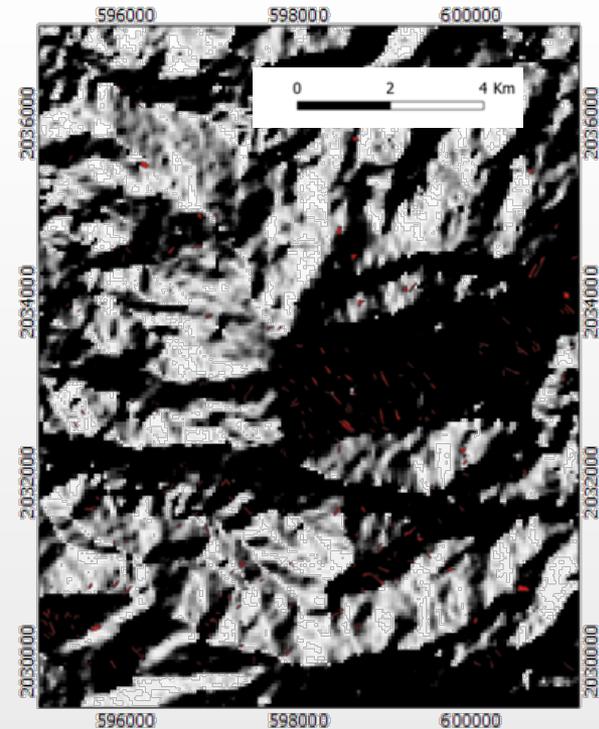
Zone 1



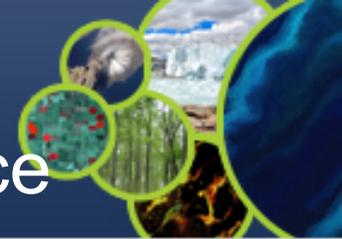
Spot 7 / Post-Matthews - P



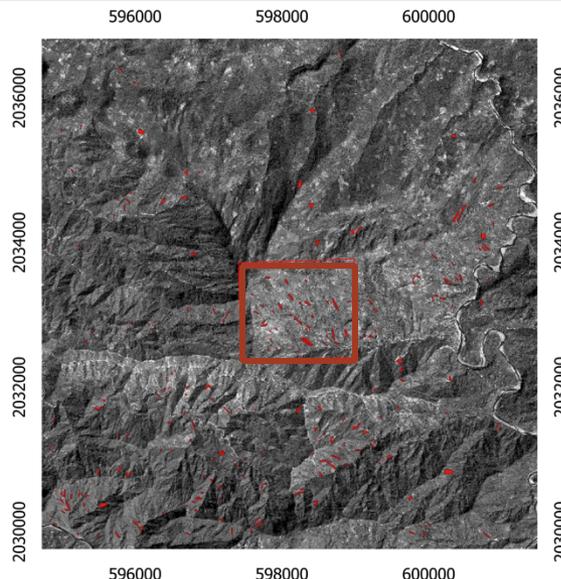
Spot 7 / Post-Matthews - MS



Spot 7 / Post-Matthews - SRTM



Zone 1

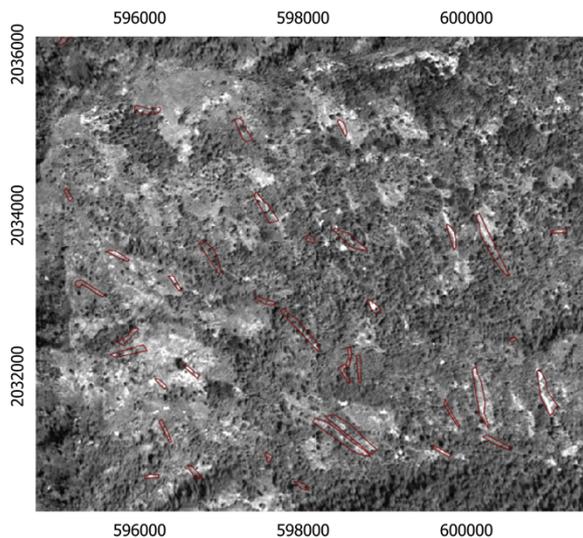


 Glissements de terrain

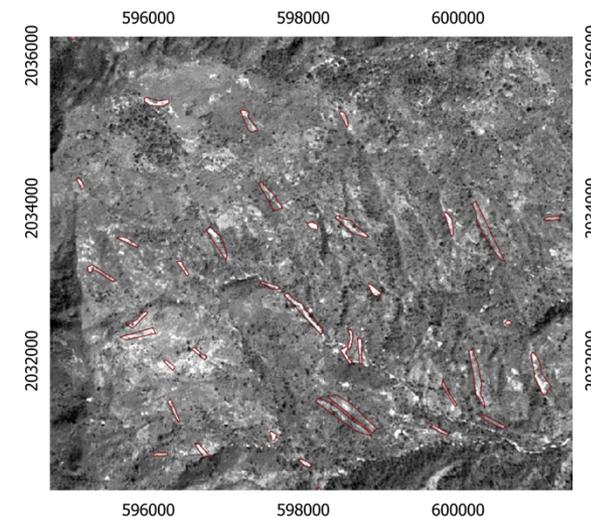
Clés d'interprétation :

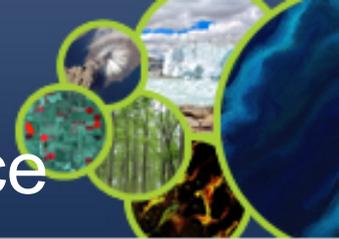
- Interprétation 1:500^e
- Images Spot 6/7 – pré/post Matthews
- Relief ombré SRTM
- Google Earth

Zoom :
Spot 6 / Pre-Matthews - P

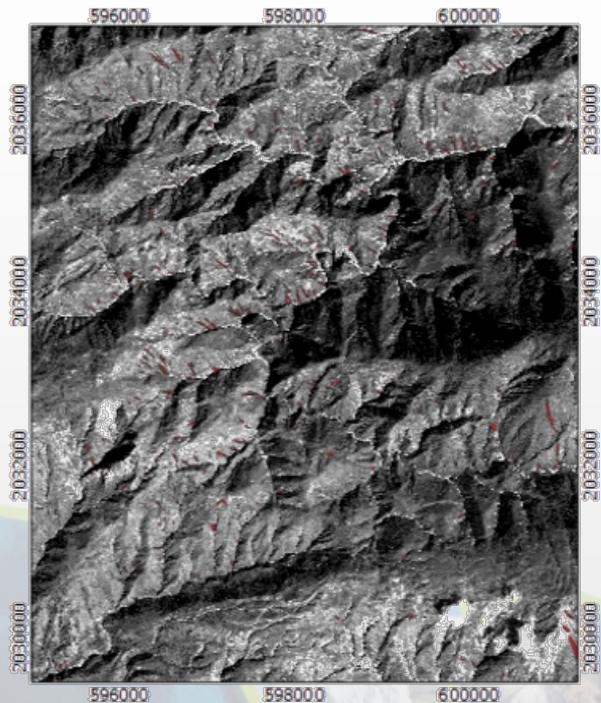


Zoom :
Spot 7 / Post-Matthews - P

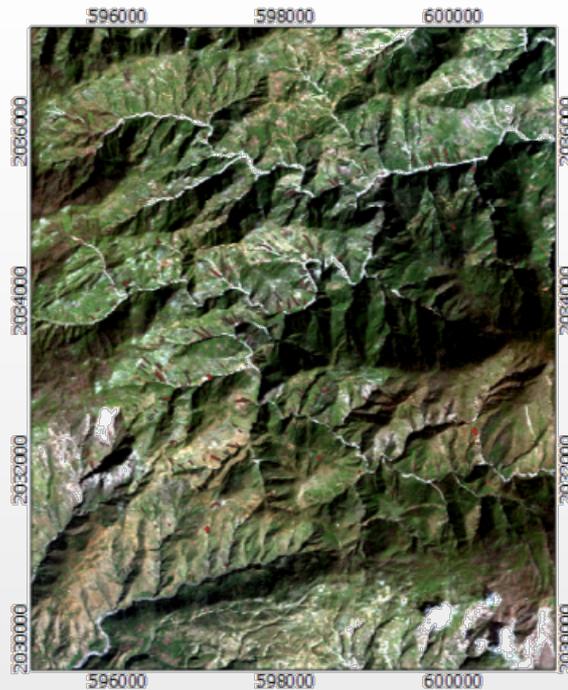




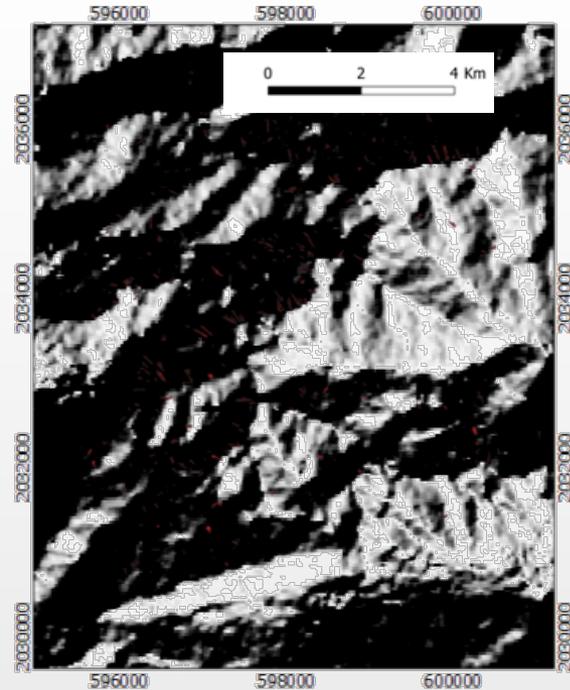
Zone 2



Spot 7 / Post-Matthews - P



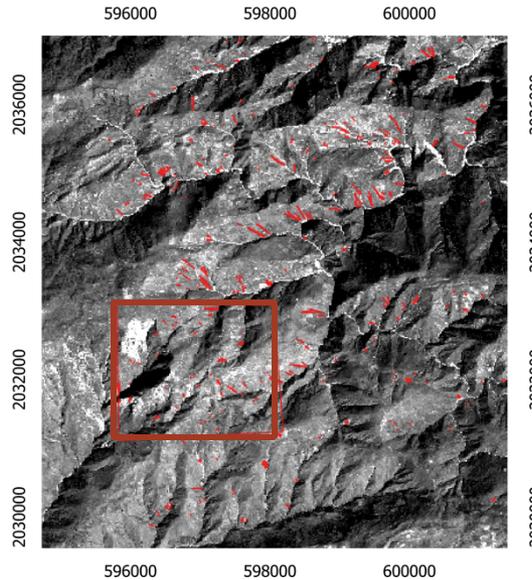
Spot 7 / Post-Matthews - MS



Spot 7 / Post-Matthews - SRTM



Zone 2

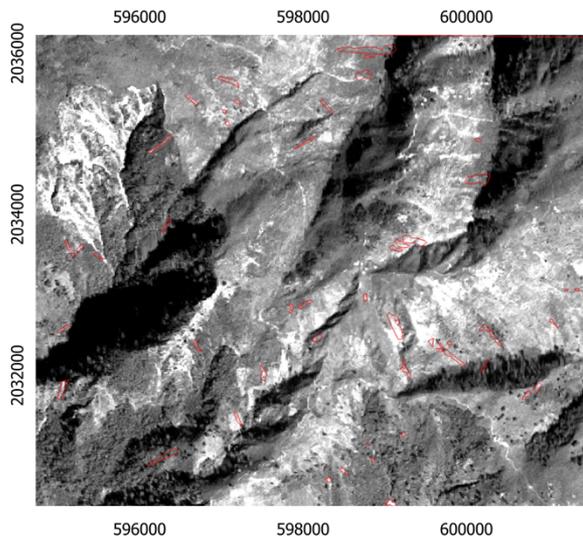


 Glissements de terrain

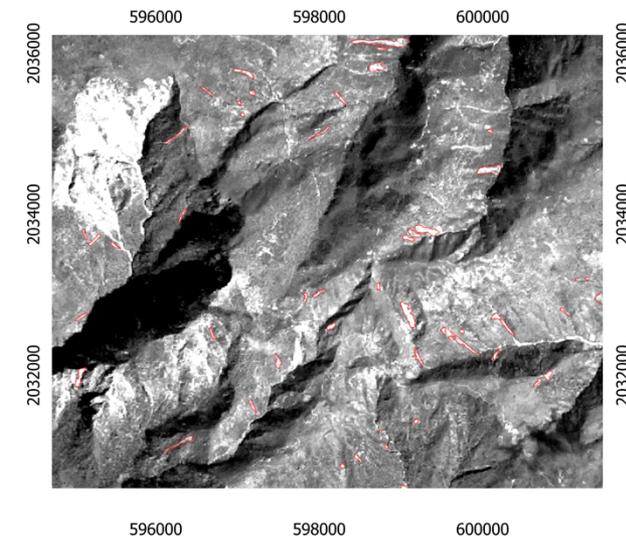
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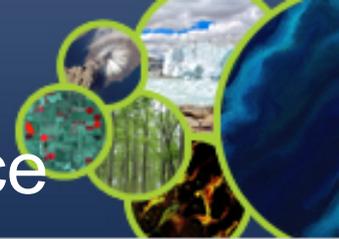
- Interprétation 1:500^e
- Images Spot 6/7 – pré/post Matthews
- Relief ombré SRTM
- Google Earth

Zoom :
Spot 6 / Pre-Matthews - P

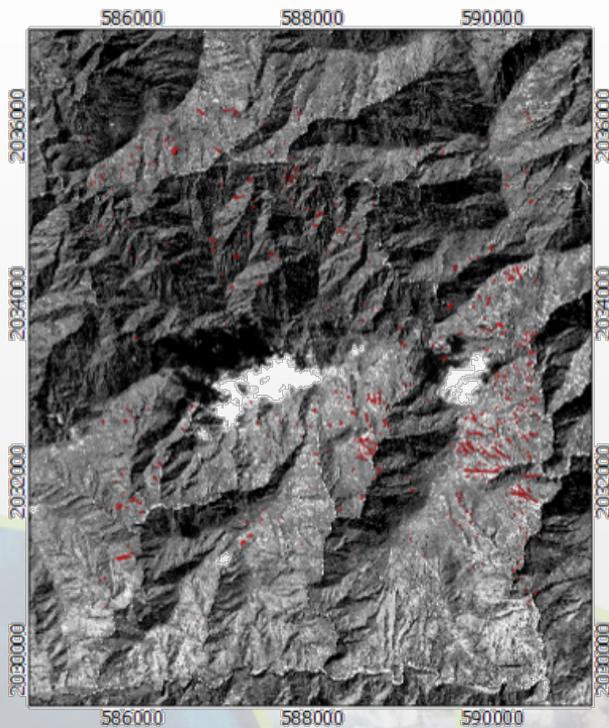


Zoom :
Spot 7 / Post-Matthews - P

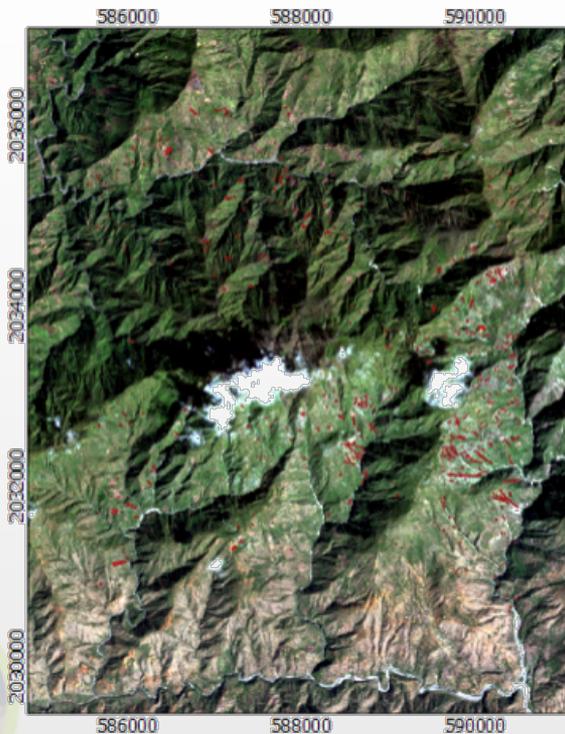




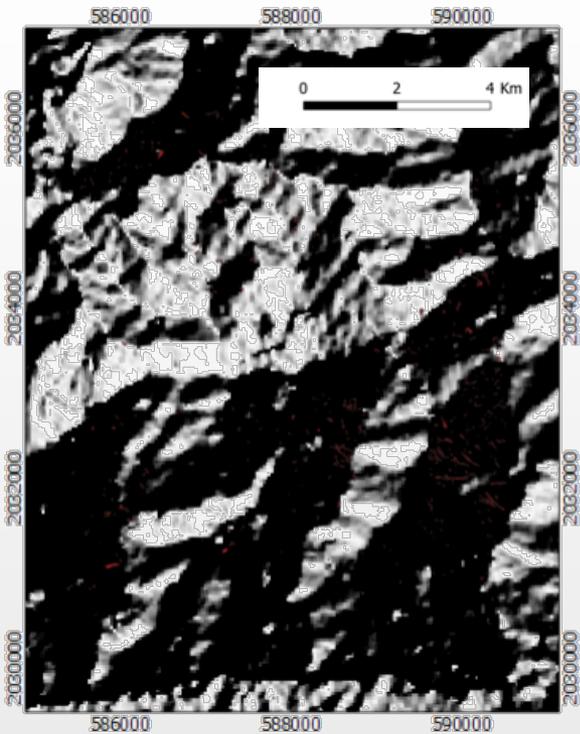
Zone 3



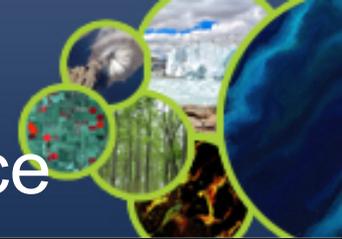
Spot 7 / Post-Matthews - P



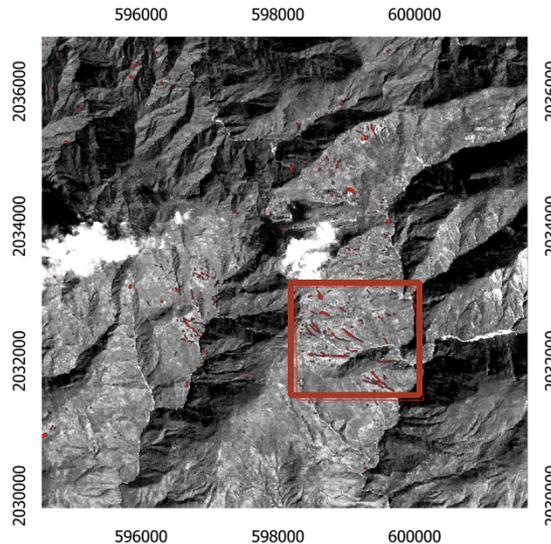
Spot 7 / Post-Matthews - MS



Spot 7 / Post-Matthews - SRTM



Zone 3

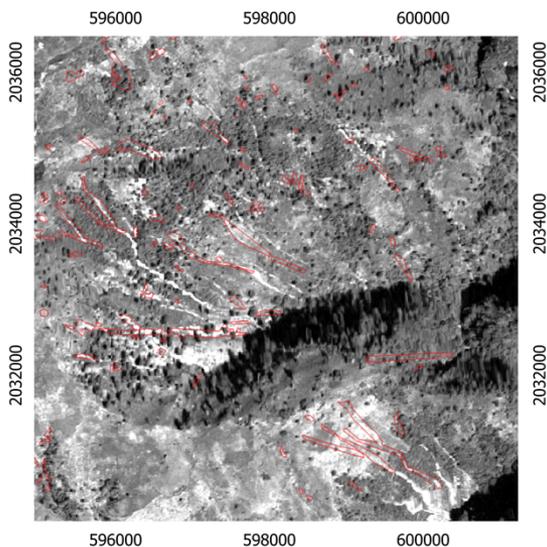


Glissements de terrain

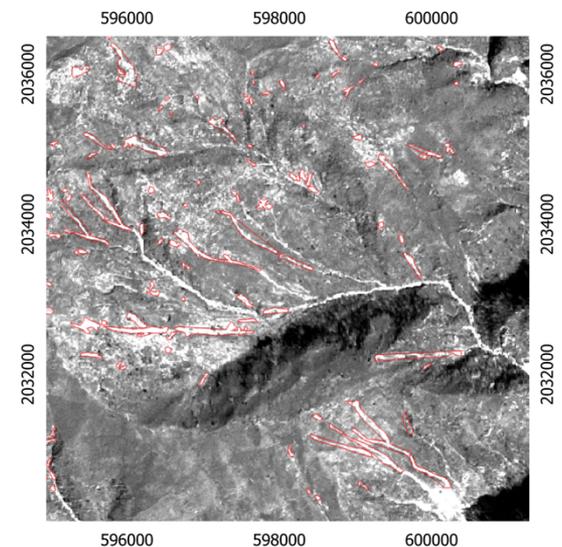
Clés d'interprétation :

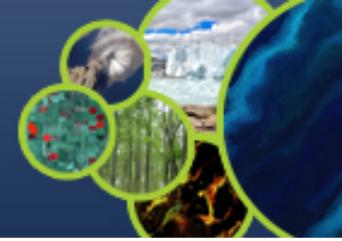
- Interprétation 1:500^e
- Images Spot 6/7 – pré/post Matthews
- Relief ombré SRTM
- Google Earth

Zoom :
Spot 6 / Pre-Matthews - P



Zoom :
Spot 7 / Post-Matthews - P

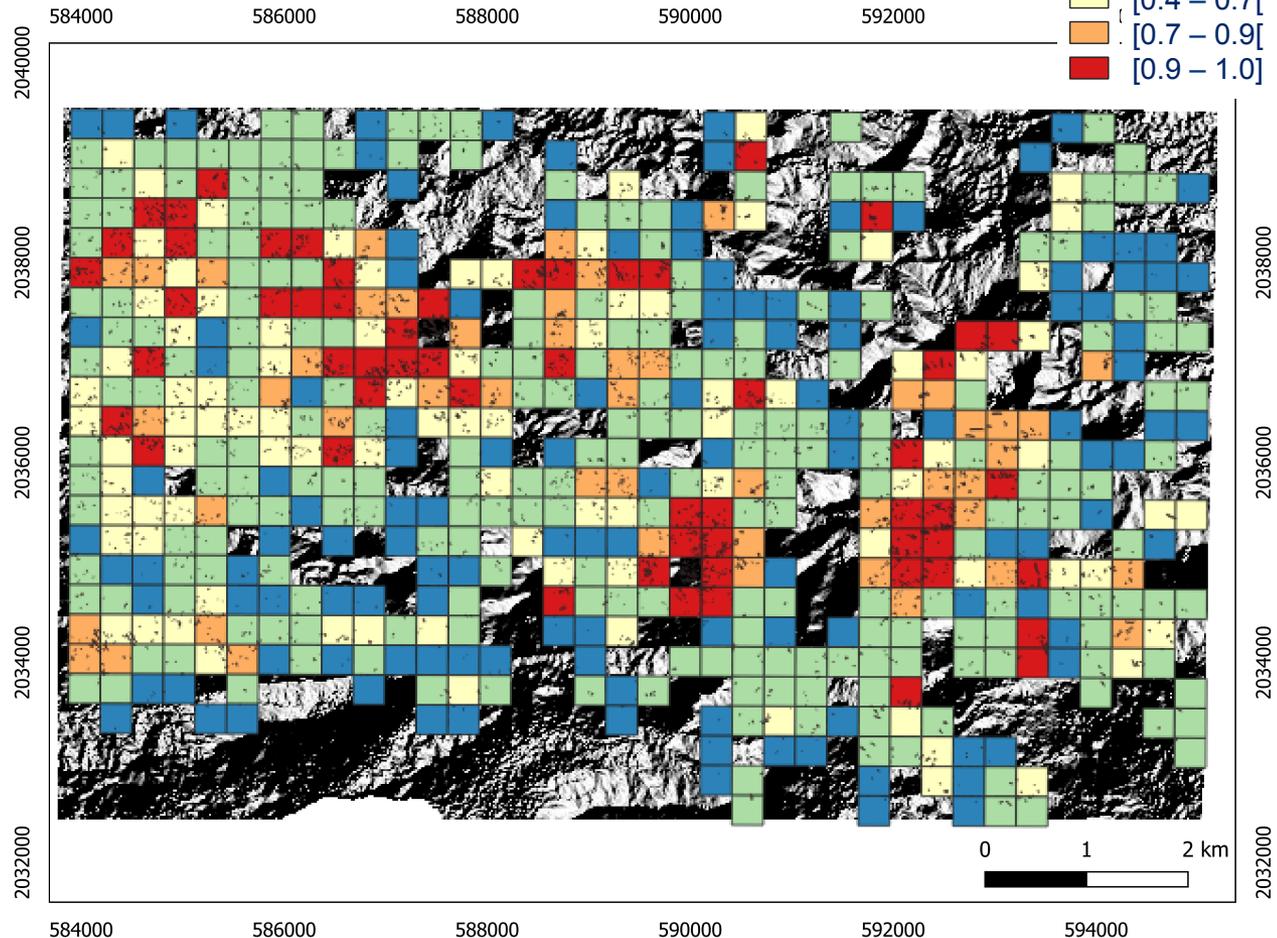
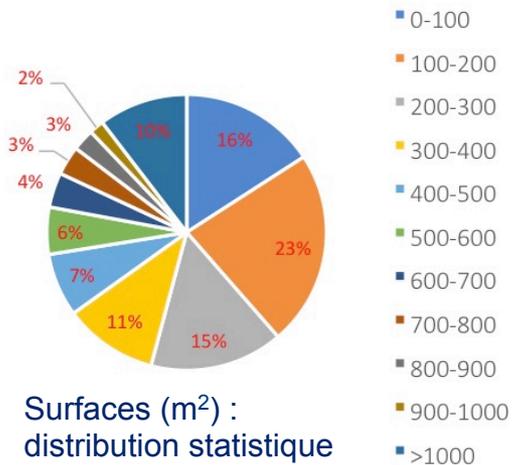
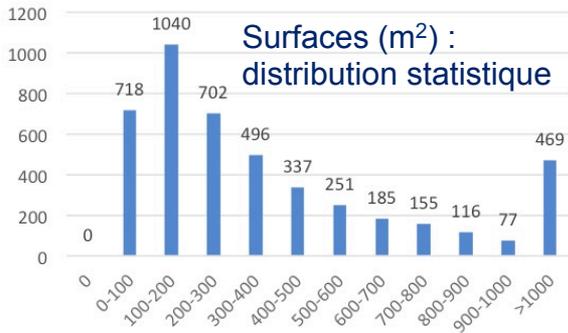
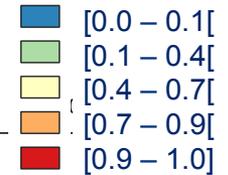




Densité de glissements de terrain (en surface) par maille de 1 km²

Nombre de glissement : > 4500

Surface affectée : 2.4 km²
(sur env. 700 km²)

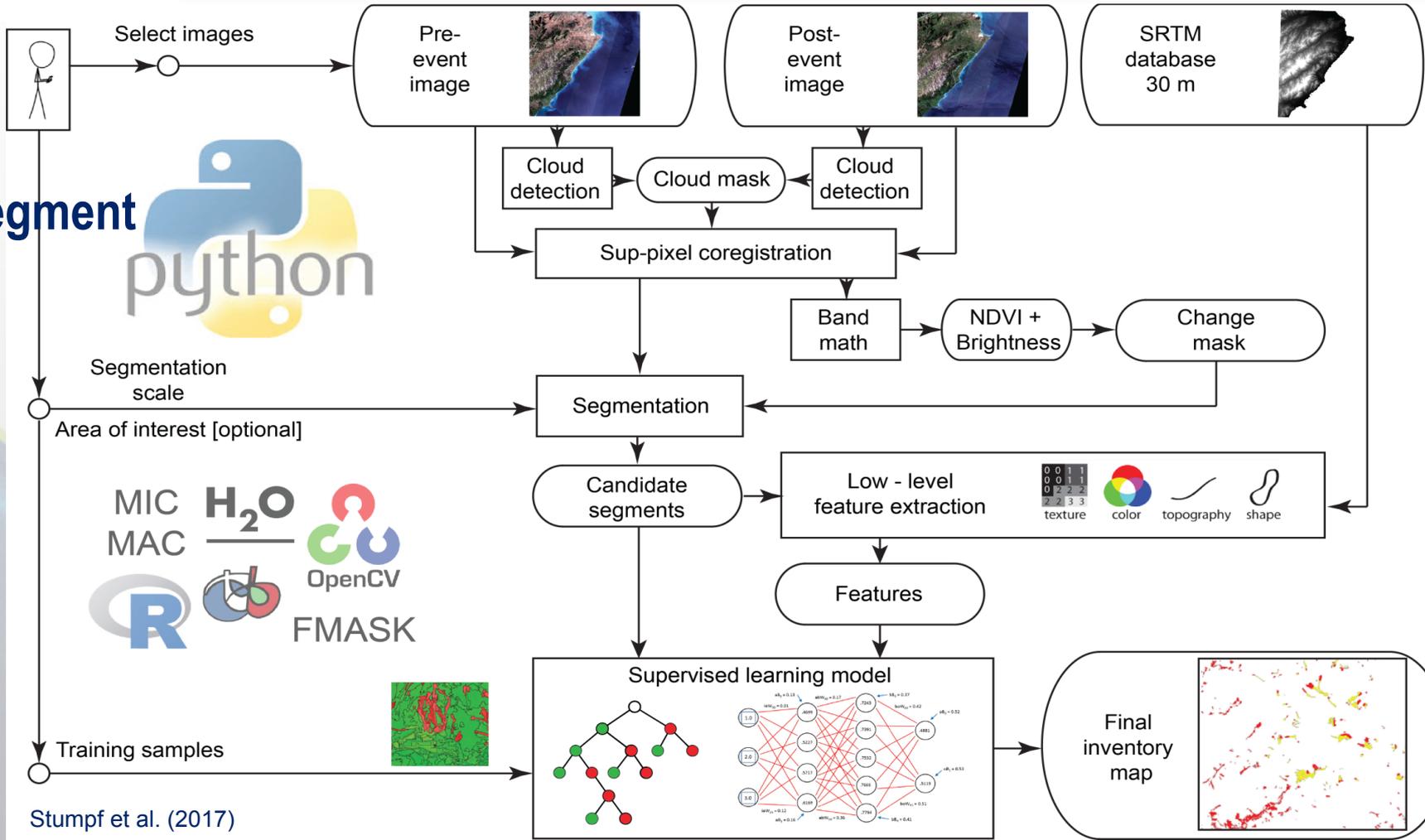




ALADIM: Automated Landslide Detection and Inventory Mapping

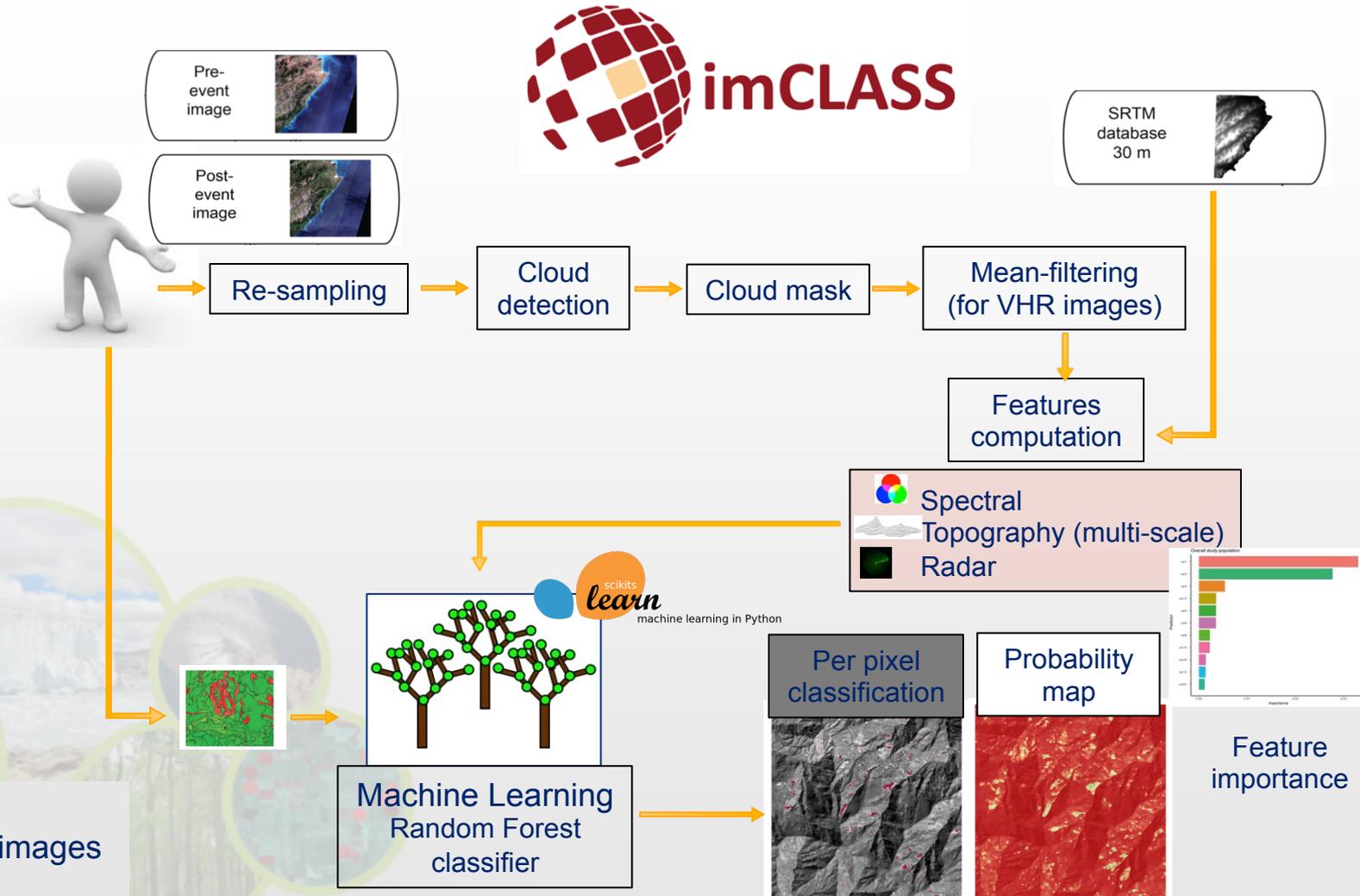
Image sources: S2 + VHRO ortho-images
Supervised method - Selection of image features – Random Forest classifier
HPC + cloud-based implementation (through dockerisation)

Per-segment



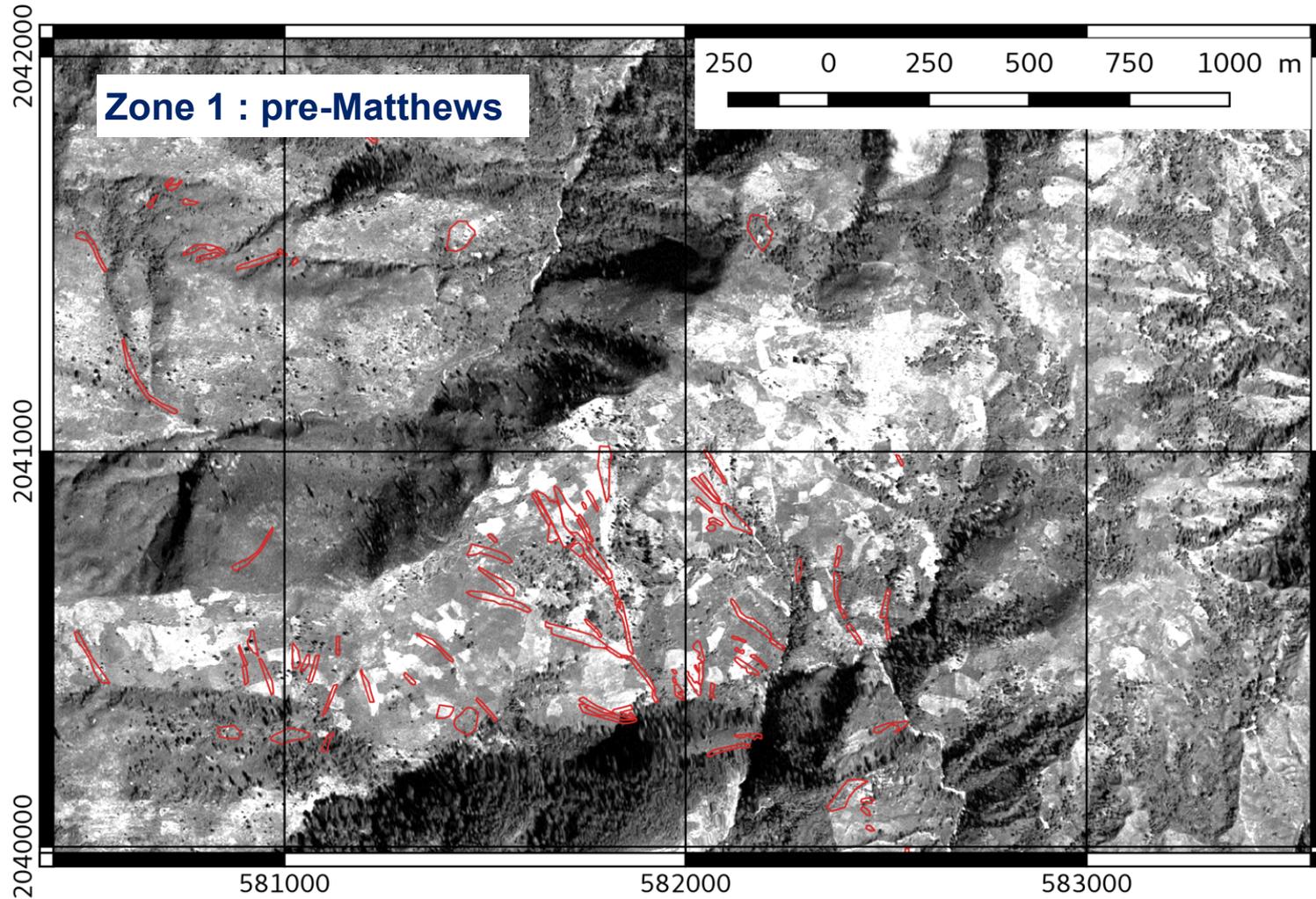


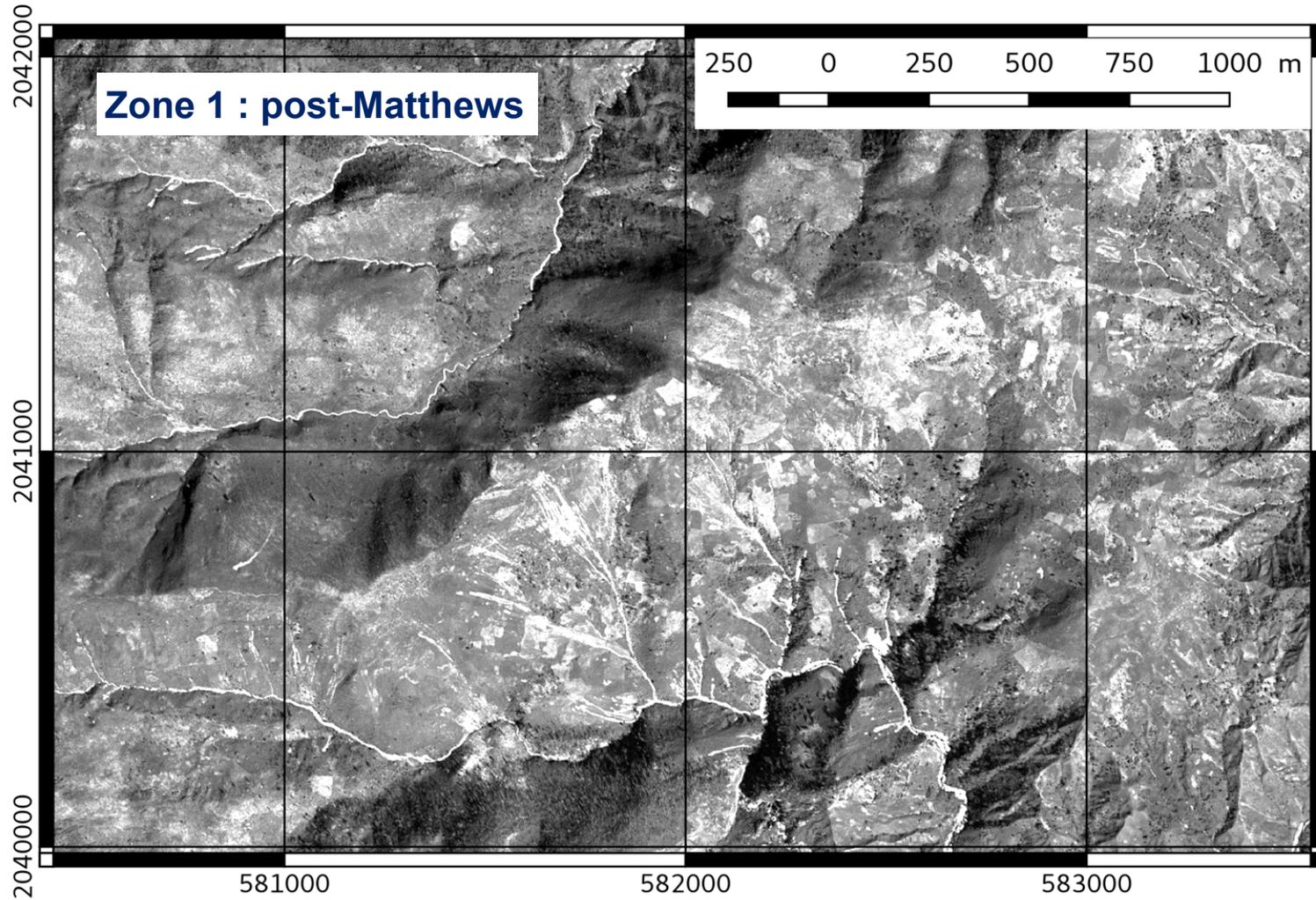
Per-pixel

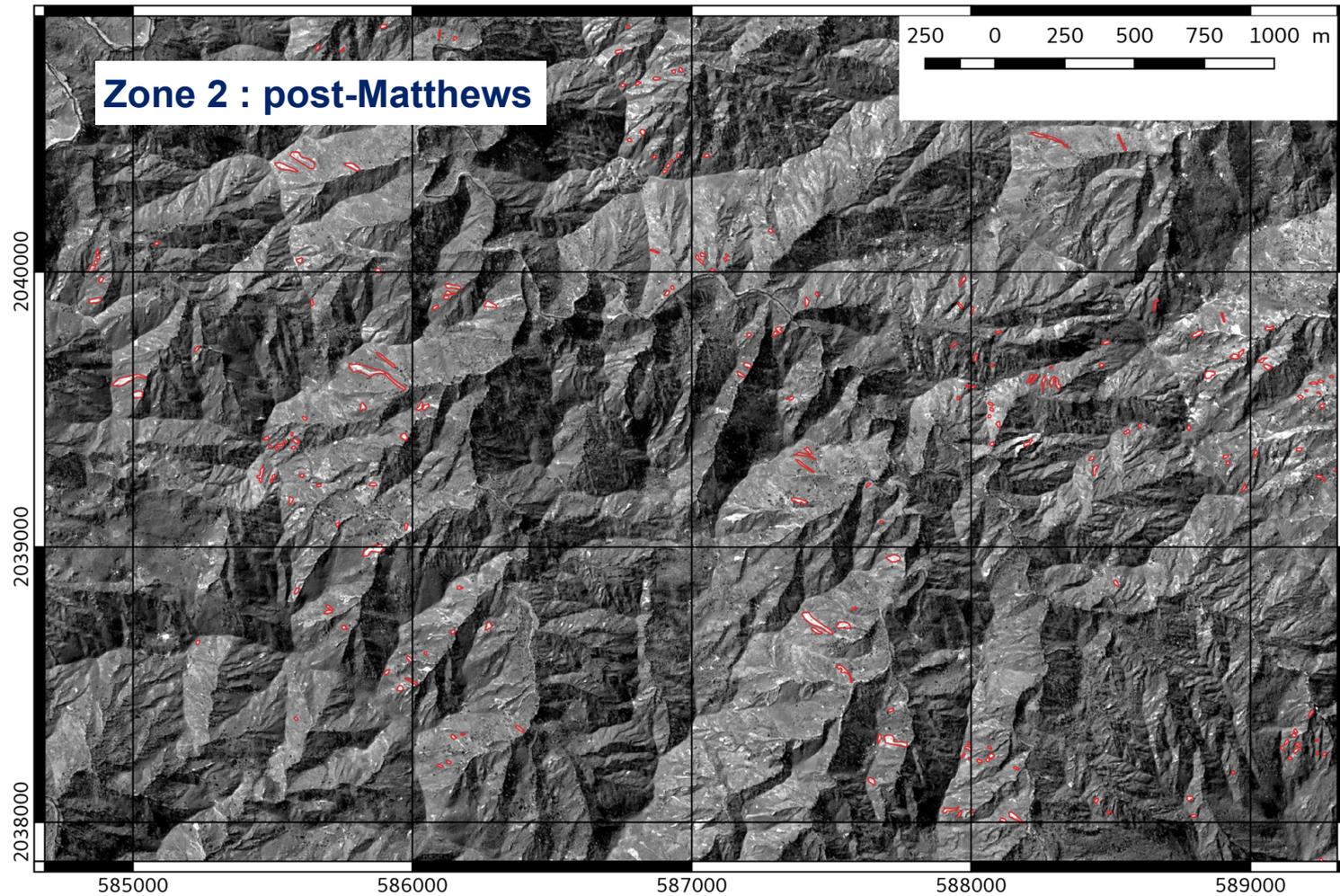


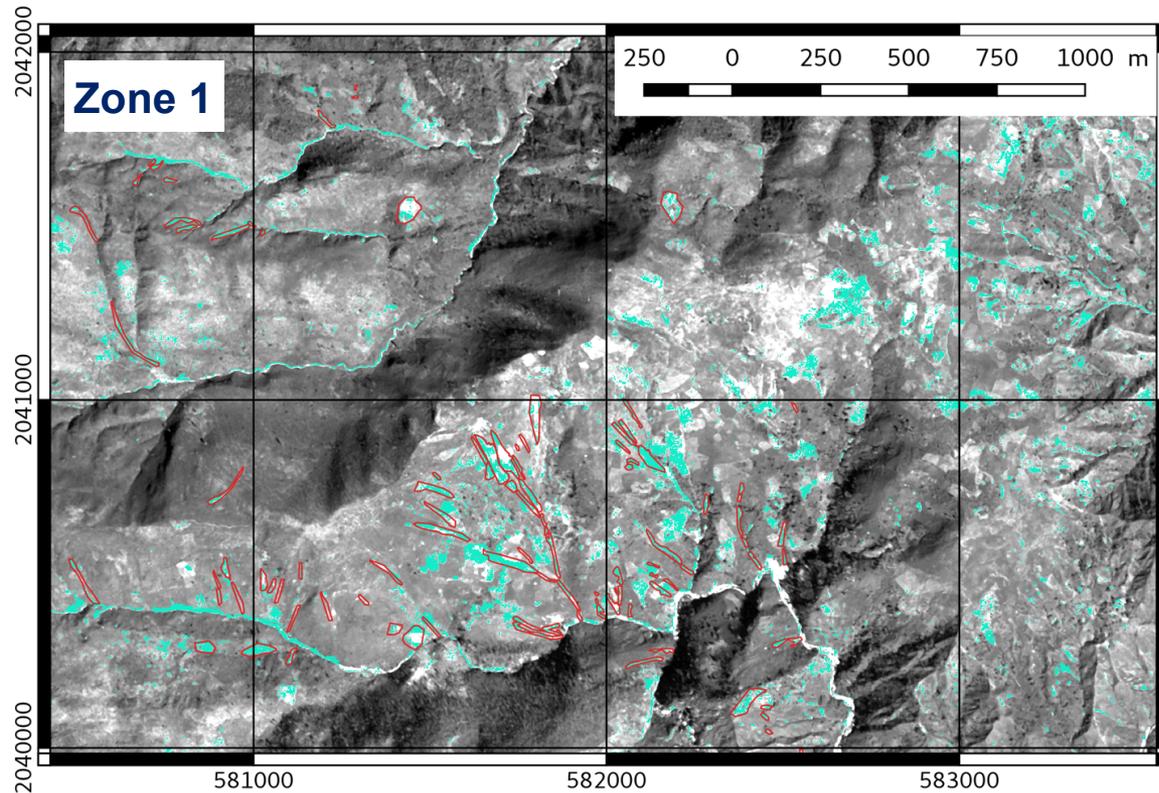
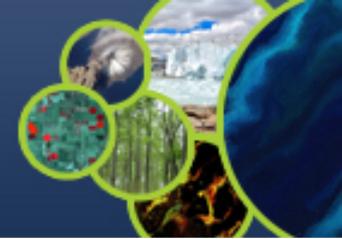
Input data

- Pre/post-event images
- Training areas
- Training samples



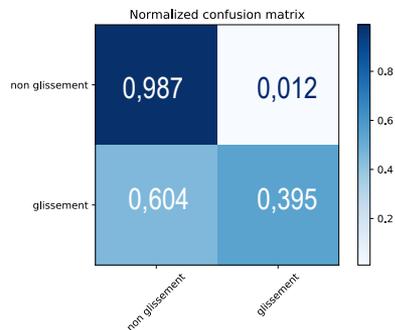
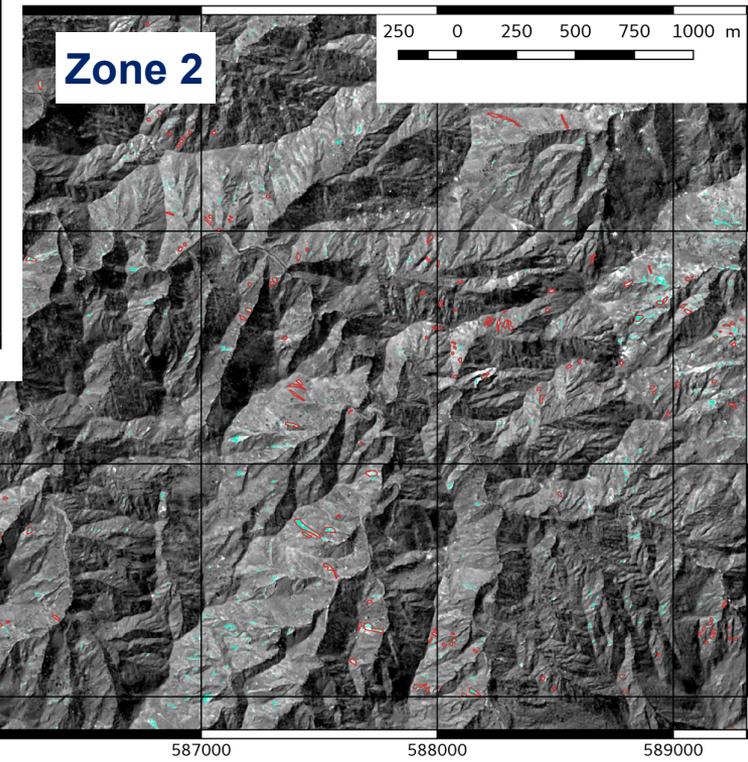


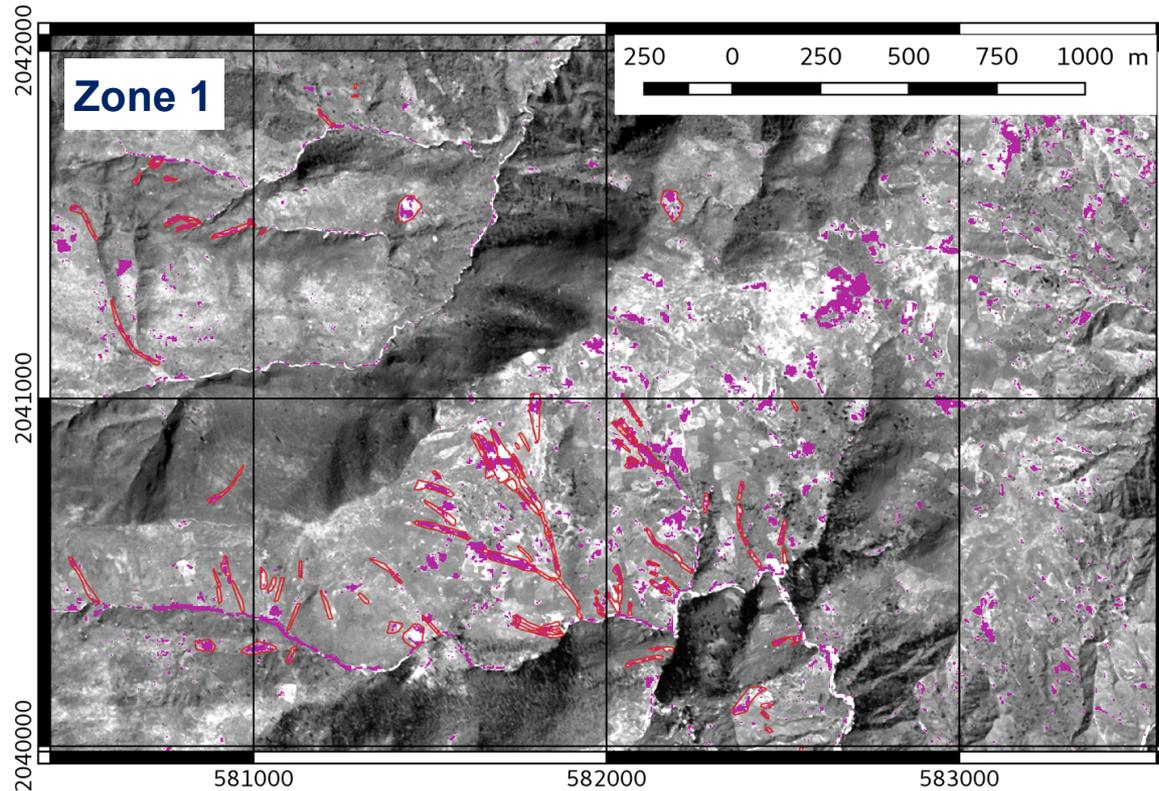




Modèle à 22 attributs

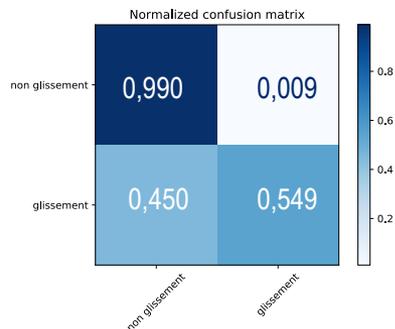
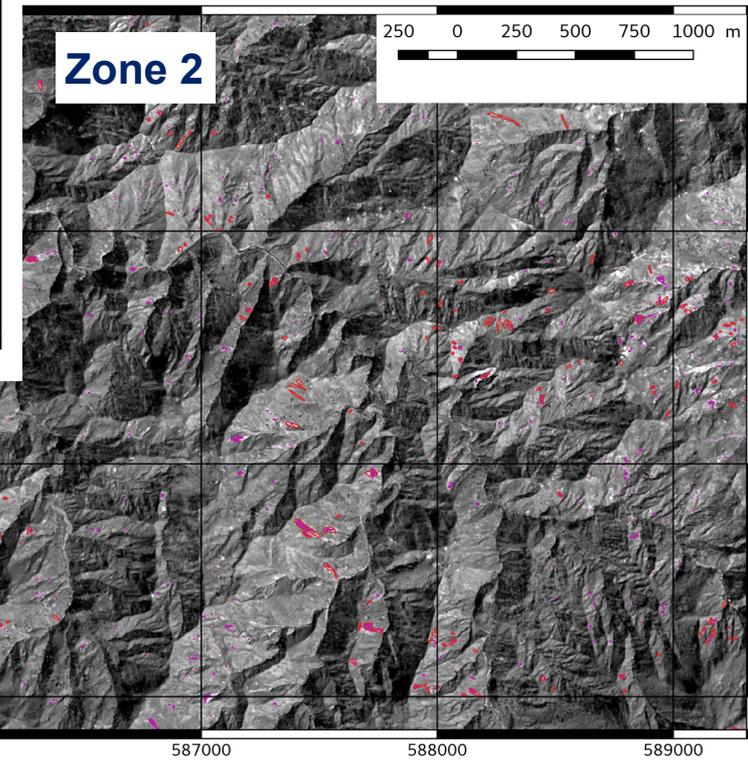
- 15 spectraux
(réflectance MS/P + NDVI -pre, post, diff-)
- 7 topographiques

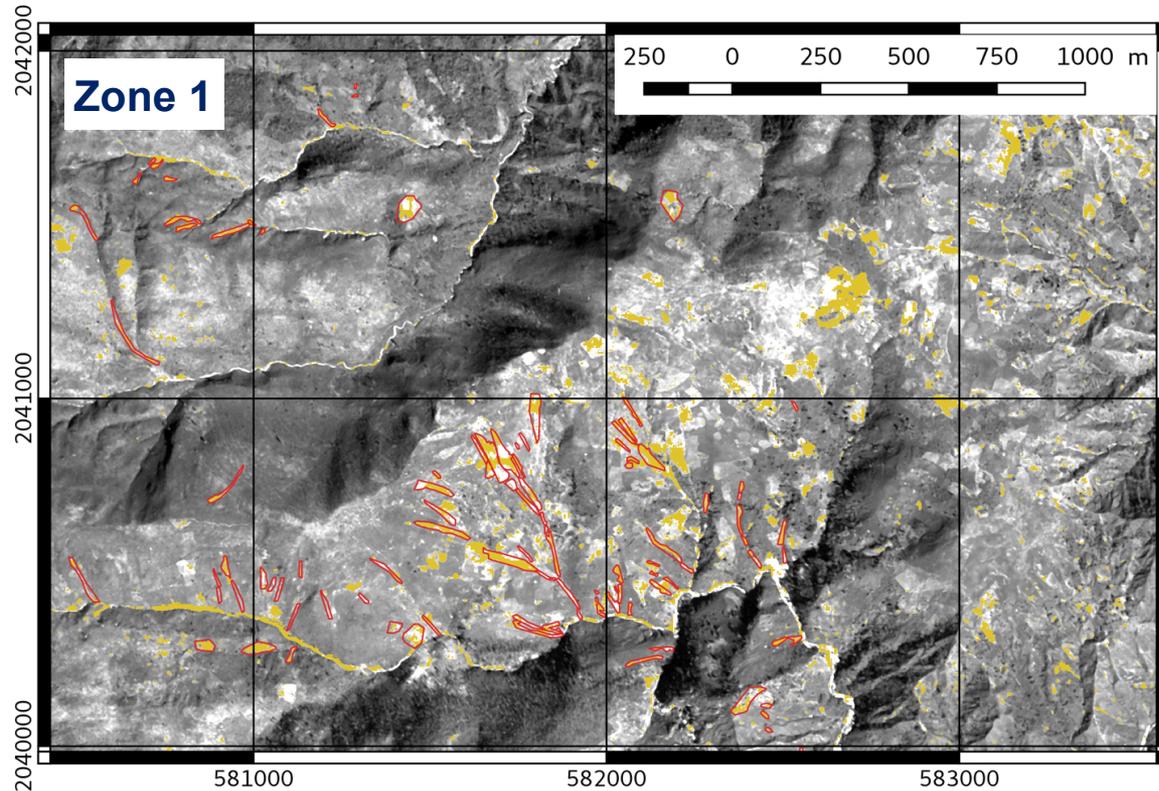
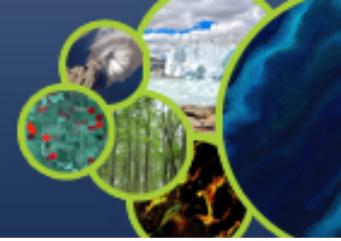




Modèle à 70 attributs

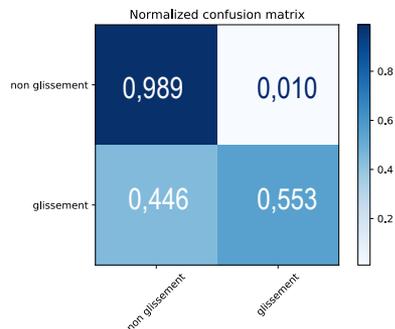
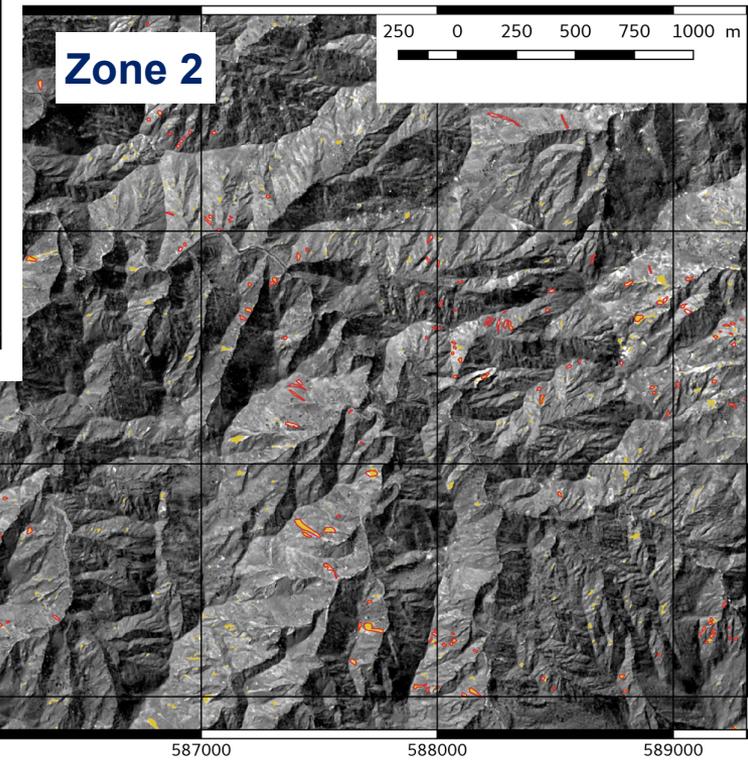
- 56 spectraux (réflectance + plusieurs indices spectraux - pre, post, diff-)
- 14 topographiques (méta-topo)
- sélection des pixels d'entraînement pad: 9 pixels





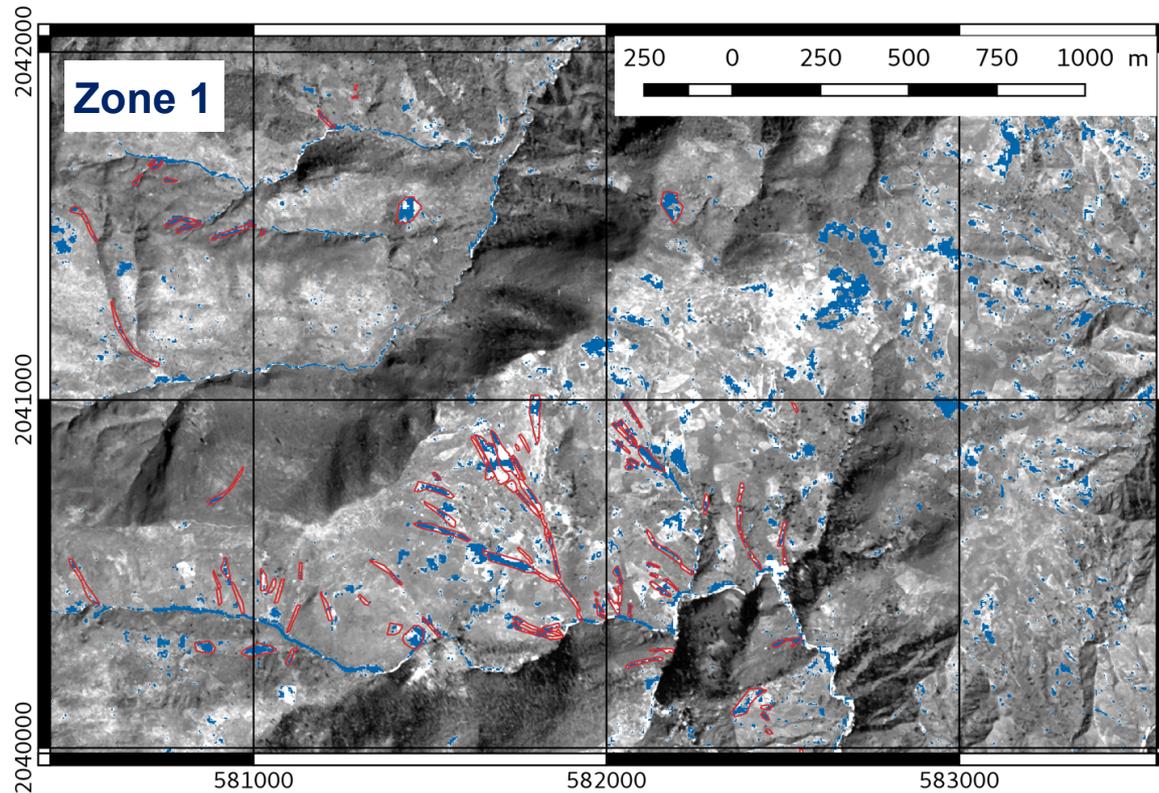
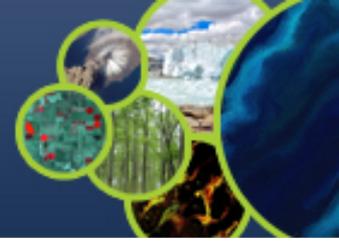
Modèle à 70 attributs

- 56 spectraux (réflectance + plusieurs indices spectraux - pre, post, diff-)
- 14 topographiques (méta-topo)
- sélection des pixels d'entraînement pad: 25 x 25 pixels



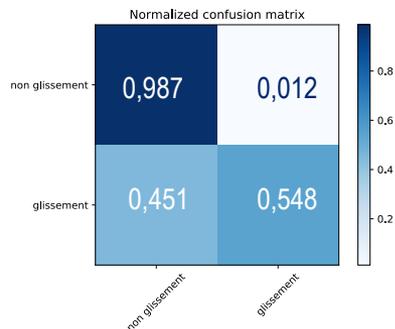
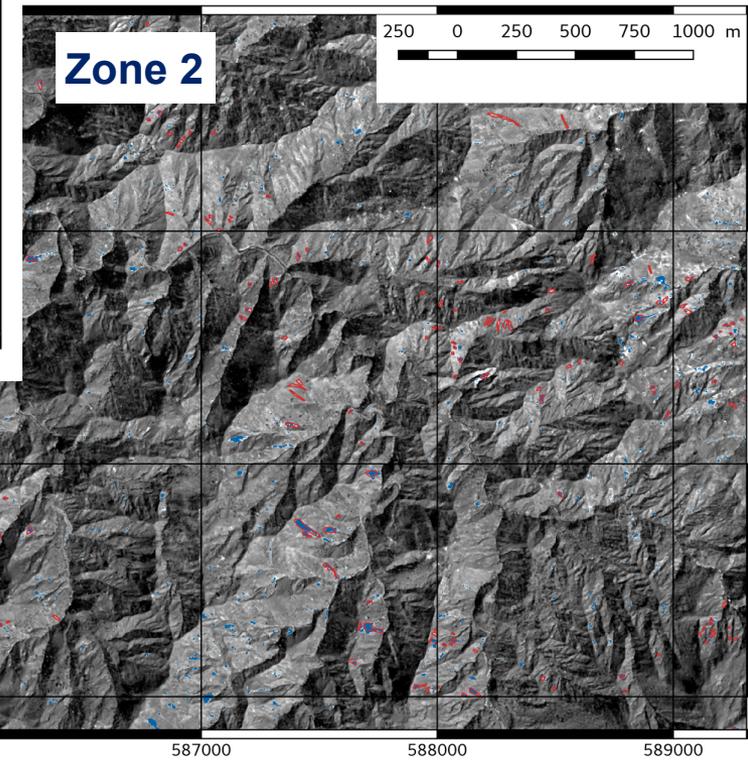
ImCLASS

Modèle 4 (spectral, sans topo)



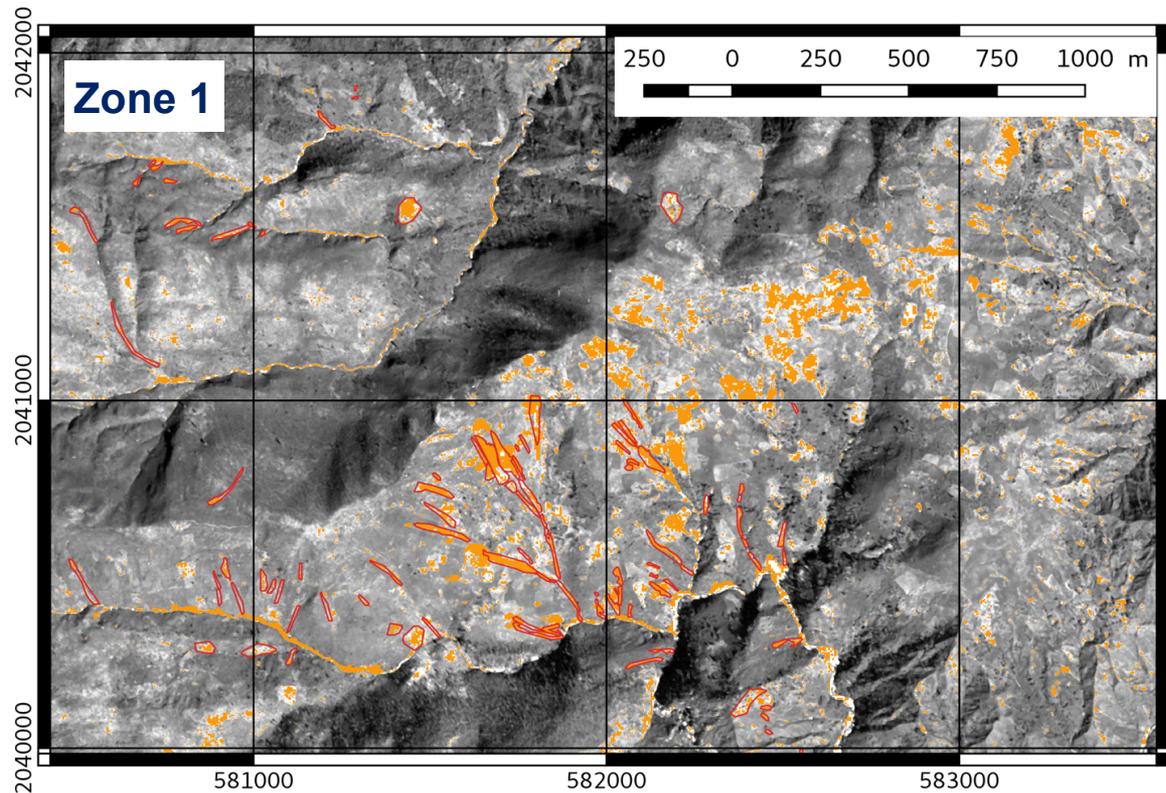
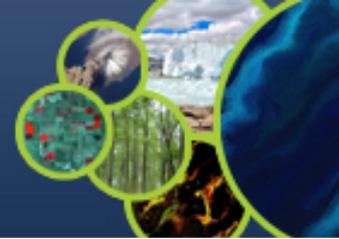
Modèle à 56 attributs

- 56 spectraux (réflectance + plusieurs indices spectraux - pre, post, diff-)
- sélection des pixels d'entraînement pad: 25 x 25 pixels



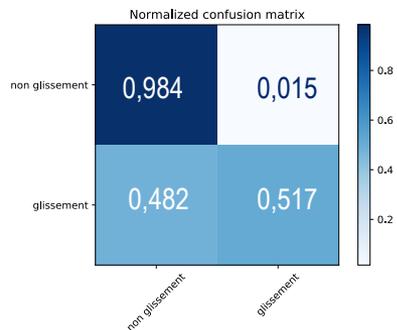
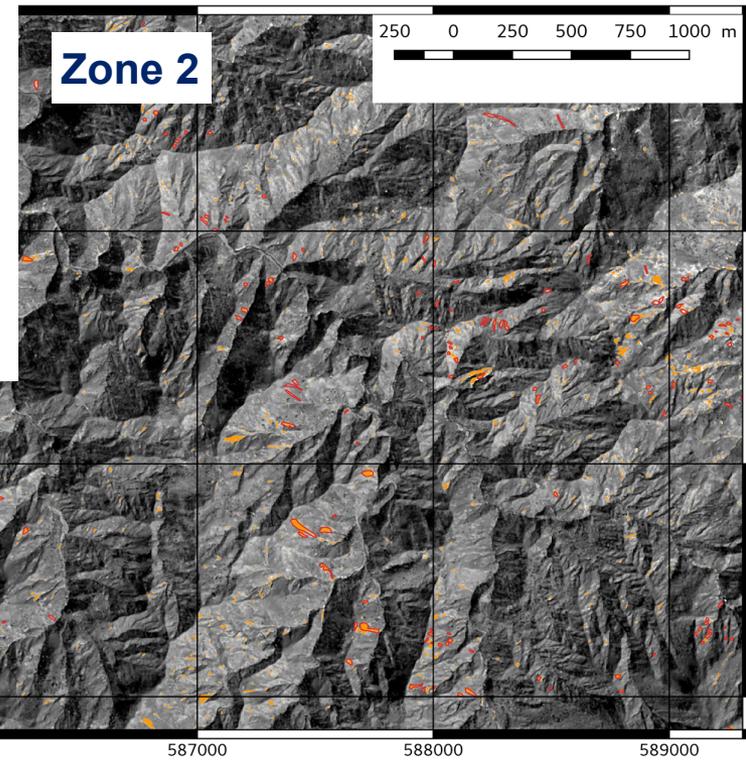
ImCLASS

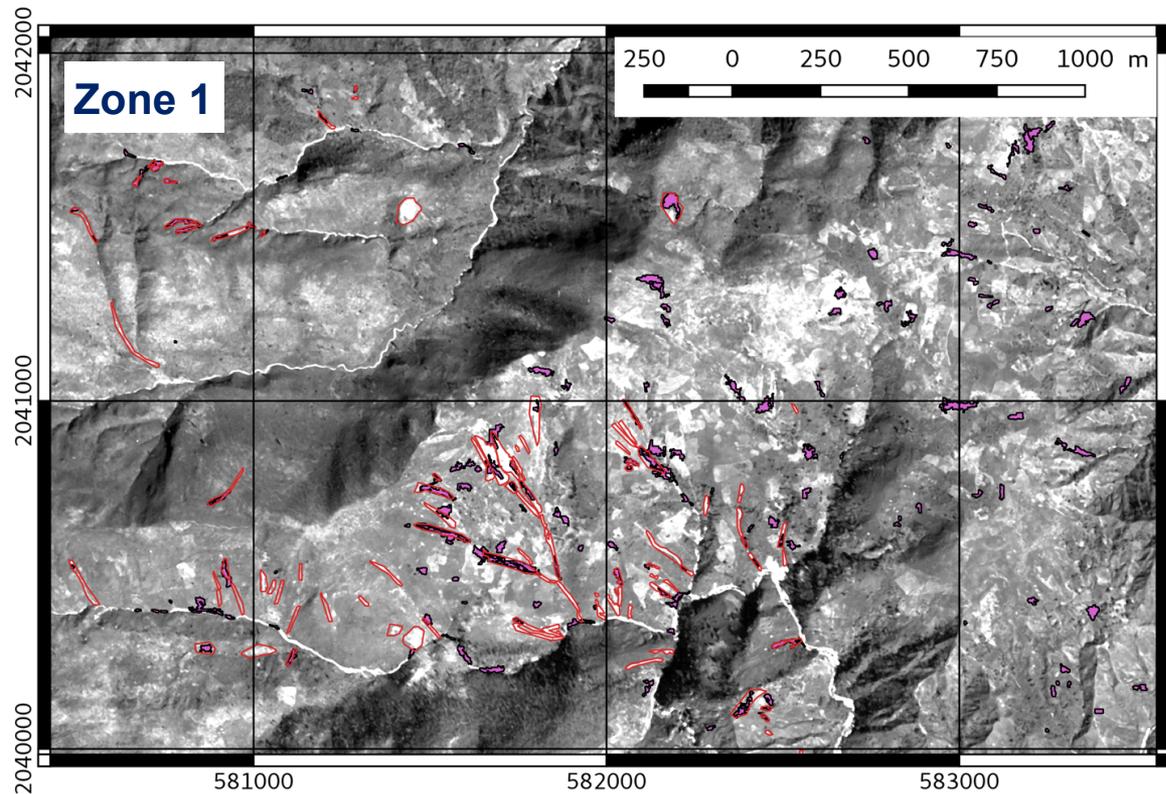
Modèle 5 (uniquement post)



Modèle à 20 attributs

- 20 spectraux (réflectance P/MS + NDVI –uniquement post)





Modèle à 20 attributs

- 20 spectraux

(réflectance + NDVI –uniquement post)

Paramètres :

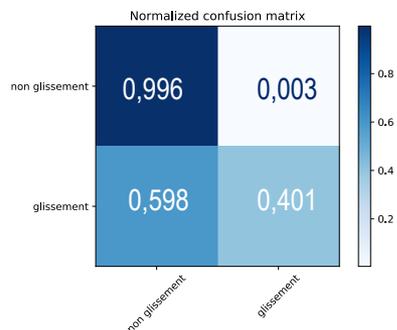
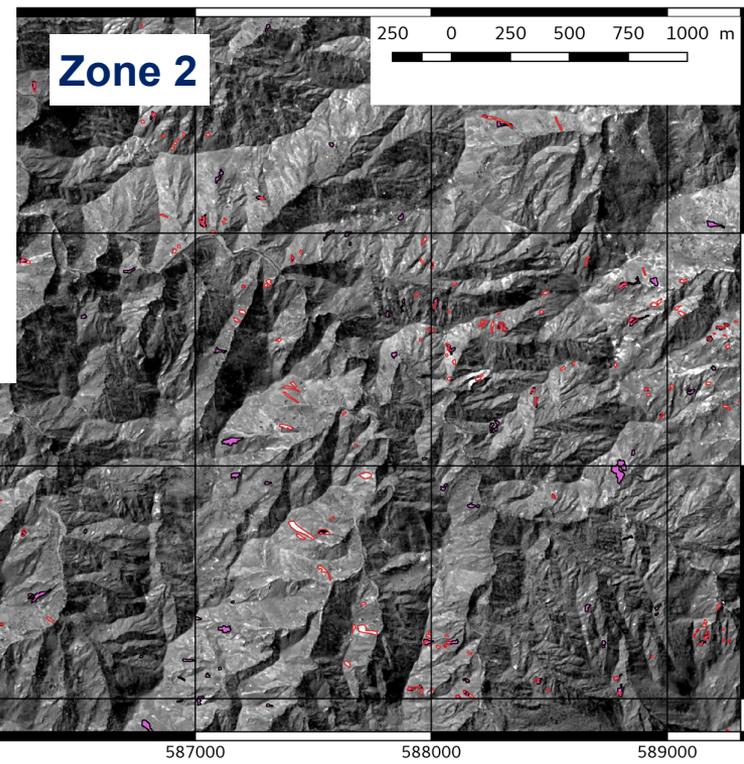
SEG_SCALE=120 ; SEG_COLOR_WEIGHT=0.9

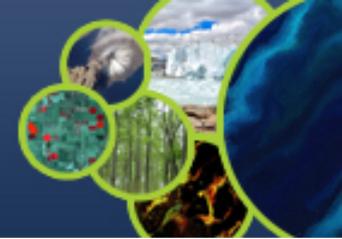
SEG_SHAPE_WEIGHT=0.1 ; SEG_N_FIRSTITER=9

SEG_MIN_SIZE=3 ; SUN_AZIMUTH=90.44,31.17

SUN_ELEVATION=64.28,40.22 ;

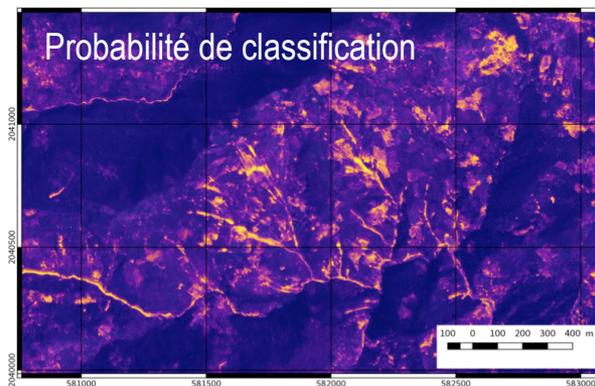
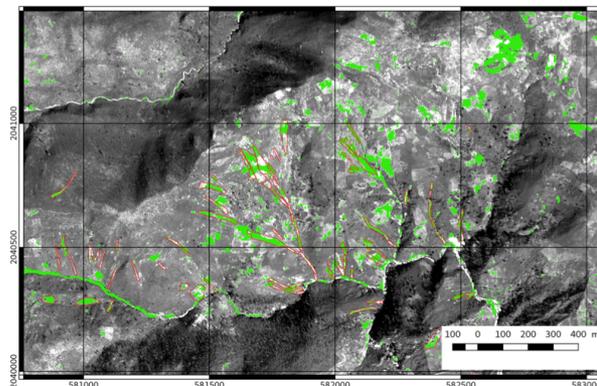
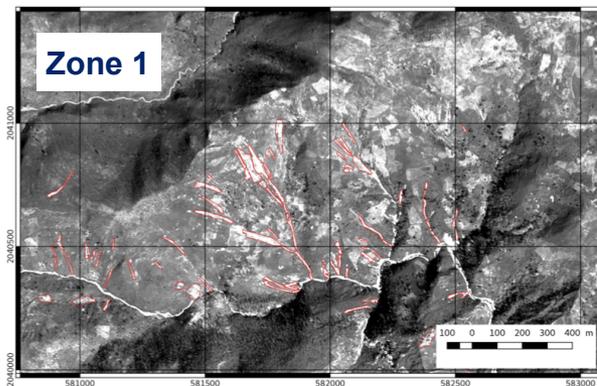
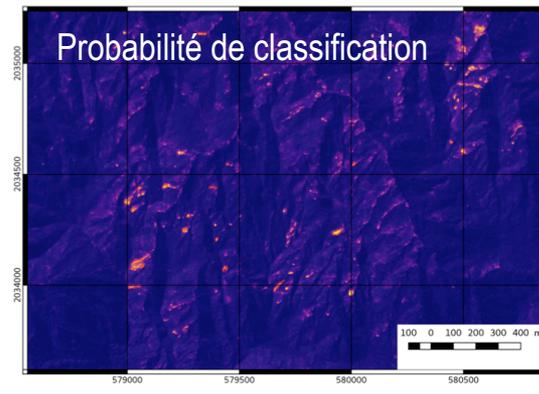
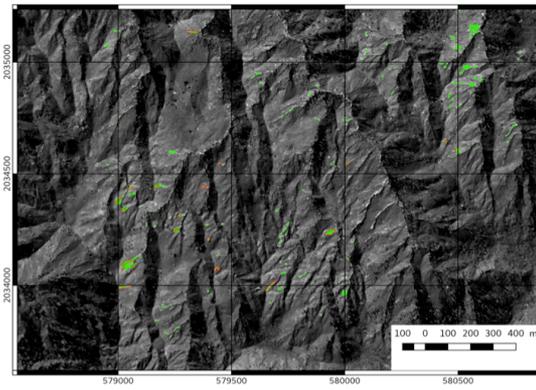
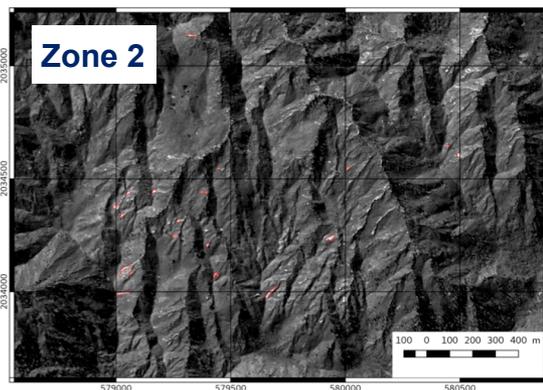
POSITIVE_THRESHOLD=0.5 ; USE_CLOUD_MASK=True





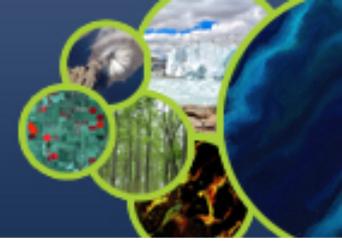
Travaux en cours :

- Attributs texturaux
- Probabilité de classification -> segmentation -> carte finale
- Boucles d'apprentissage actif
- Post-traitement (filtrage)

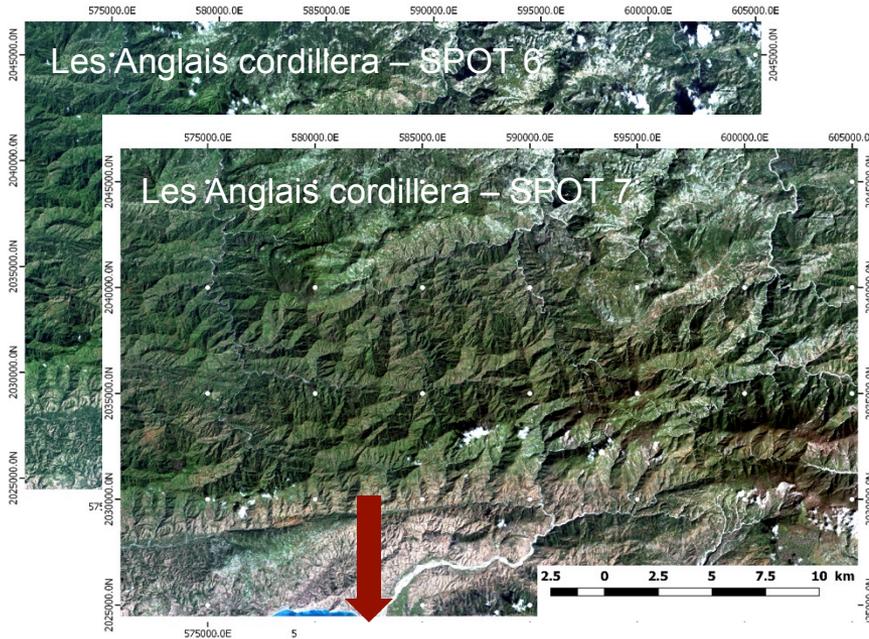


Pixels classés 'glissements'

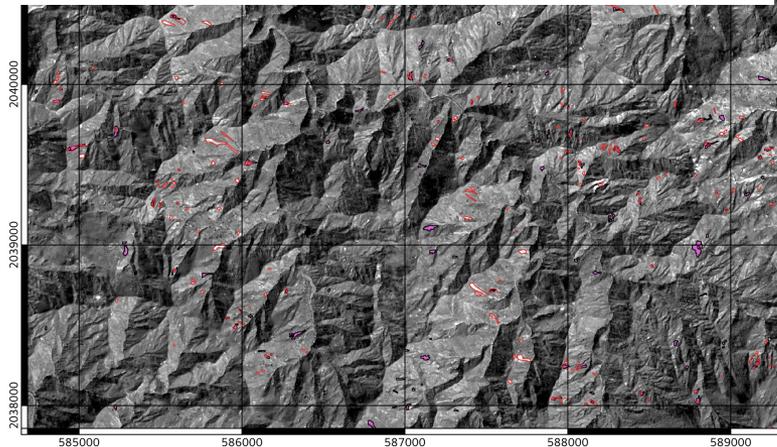




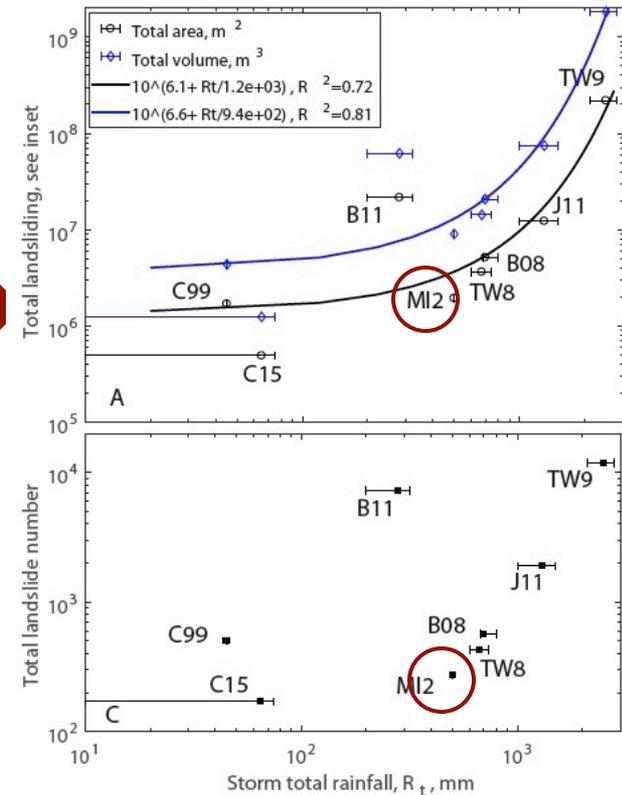
Calculs de statistiques avancées Lois d'échelle « pluie – surface affectée »



Inventaire de glissement dérivés de l'imagerie



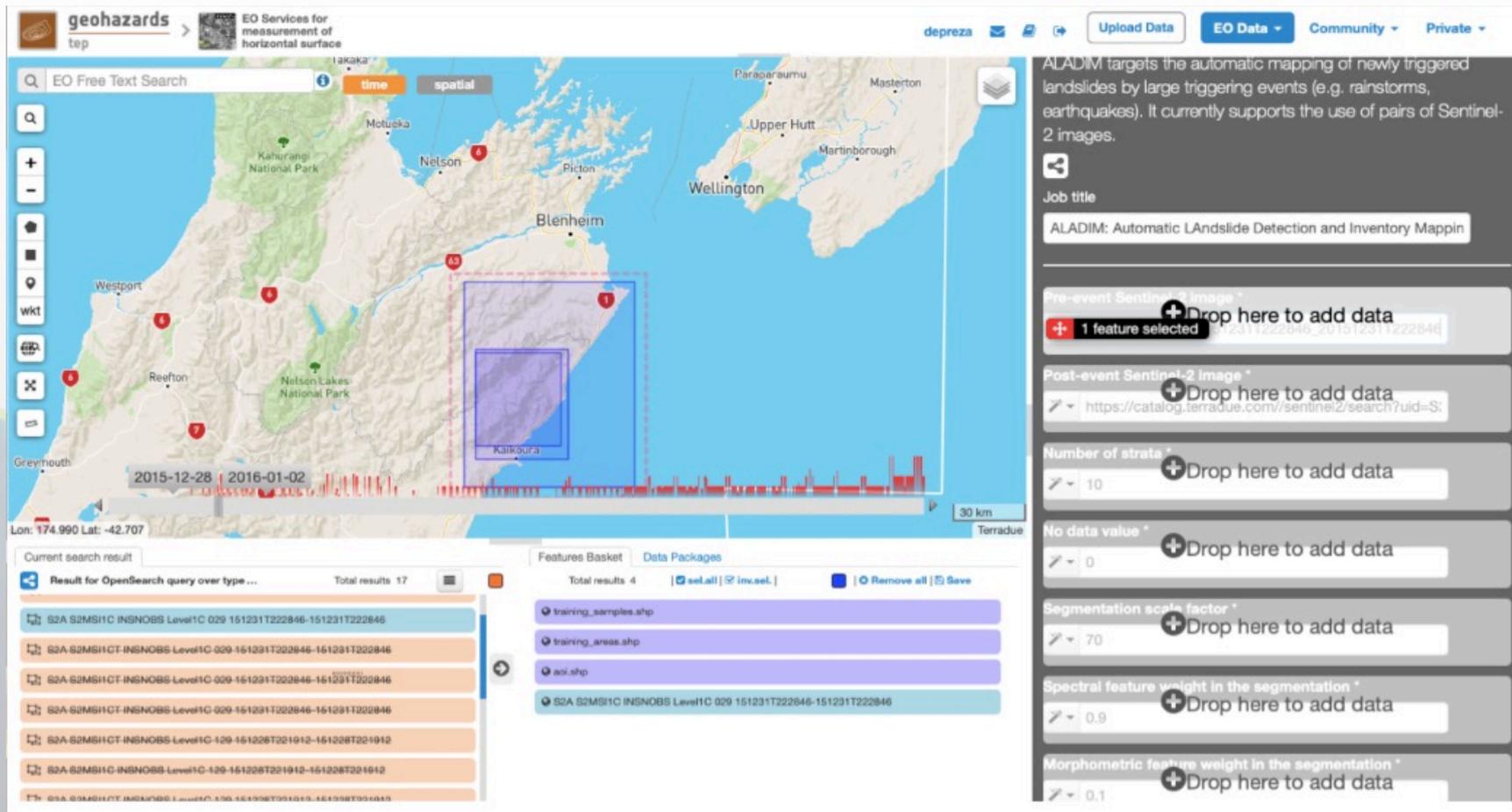
Statistiques de glissements et relations avec les propriétés des cyclones (ex. de cyclones récents)



1. Finaliser le traitement sur le secteur RO complet (emprise globale Spot6/Spot7)
2. Finaliser les expérimentations ImCLASS / ALADIM : attributs texturaux, apprentissage actif, masque (géologique / topographique / occsol)
3. Transmettre l'inventaire de référence et le meilleur inventaire "satellite" au BME – Echanges à prévoir sur l'intérêt d'une production après chaque évènement ? "Observatoire Spatial Gravitaire" en Haiti ?



4. Promotion des outils / plateforme en ligne (tutoriel, formation) : GEP

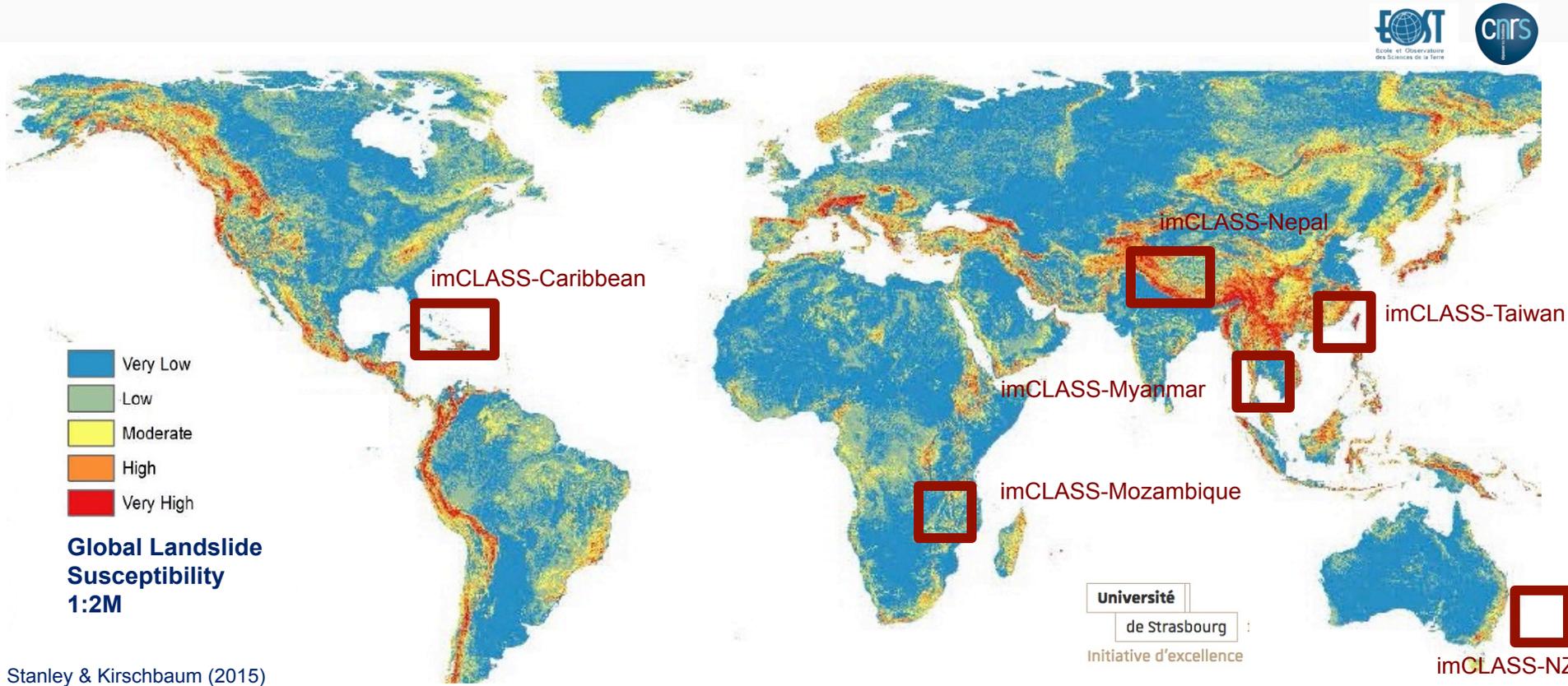


The screenshot displays the 'geohazards' web application interface. At the top, there is a search bar labeled 'EO Free Text Search' and navigation tabs for 'time' and 'spatial'. The main map shows a geographical area in New Zealand with a red dashed box highlighting a specific region. Below the map, there is a timeline showing dates from 2015-12-28 to 2016-01-02. The interface includes several panels:

- Current search result:** A list of search results with details like 'S2A S2MS1C INSNOBS Level1C 029 151231T222846-151231T222846'.
- Features Basket:** A list of selected features including 'training_samples.shp', 'training_areas.shp', 'aoi.shp', and 'S2A S2MS1C INSNOBS Level1C 029 151231T222846-151231T222846'.
- Data Packages:** A section for managing data packages.
- Job title:** 'ALADIM: Automatic LAndslide Detection and Inventory Mappin'.
- Configuration panels:** Several panels for configuring the analysis, such as 'Pre-event Sentinel-2 Image', 'Post-event Sentinel-2 Image', 'Number of strata', 'No data value', 'Segmentation scale factor', 'Spectral feature weight in the segmentation', and 'Morphometric feature weight in the segmentation'.



5. Concept actuellement discuté avec d'autres partenaires pour application sur d'autres secteurs géographiques



Stanley & Kirschbaum (2015)