

Photogrammetric and Topometric Systems Research Group

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Principal Researcher

Group of the University of Jaén (Spain)
that develops research in the field of
capture and processing of geographic
information and its applications.

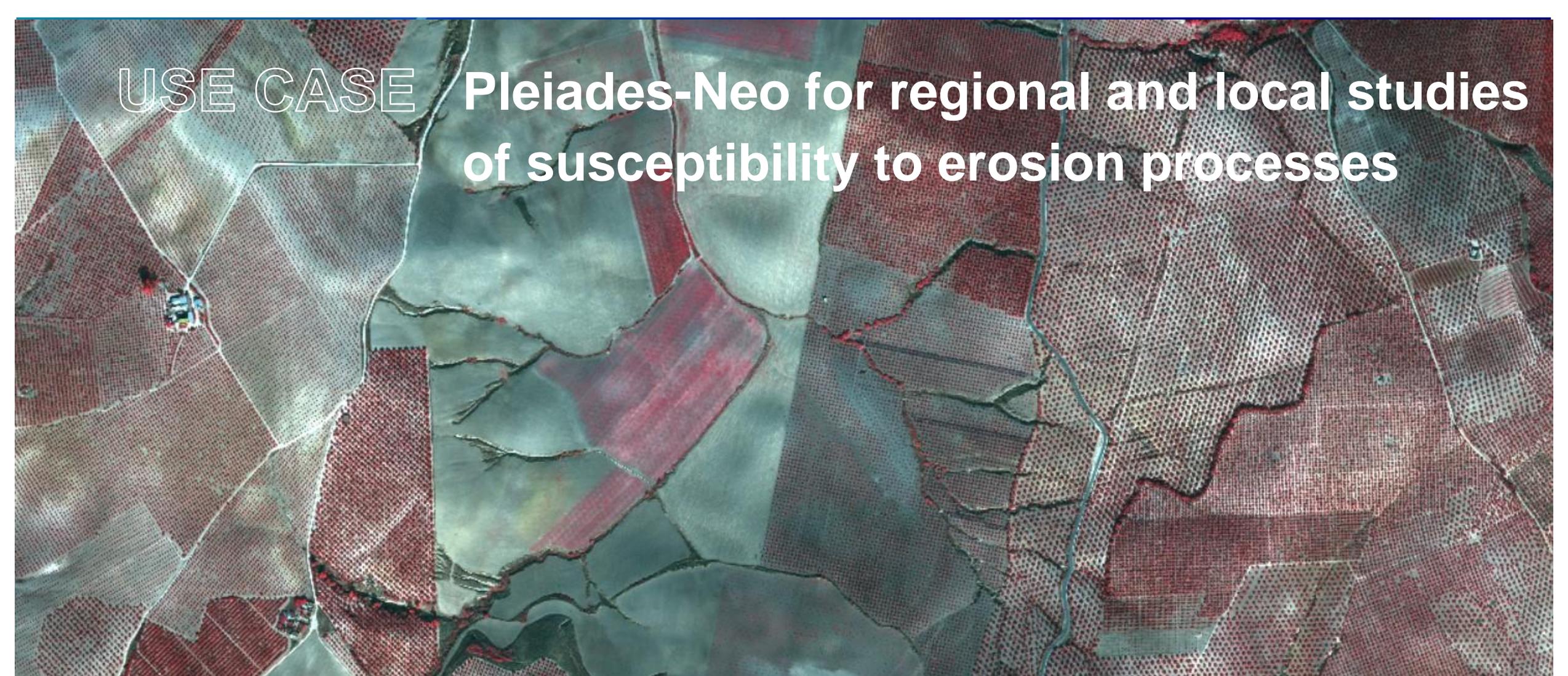
In this use case, we have analyzed the
potential of using Pleiades-Neo
imagery to obtain useful information for
the characterization of hydric erosion
processes.



Universidad
de Jaén



AIRBUS



USE CASE Pleiades-Neo for regional and local studies of susceptibility to erosion processes

Application: Erosion susceptibility estimation

Location: Andalusia, Spain (areas in Córdoba and Jaén provinces)

Products: Pleiades Neo



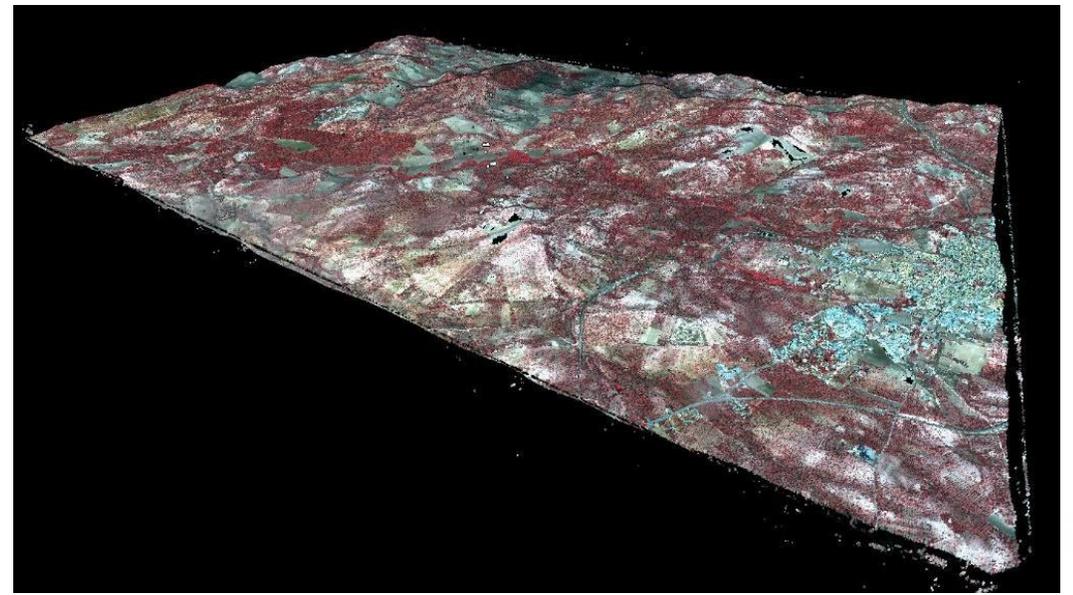
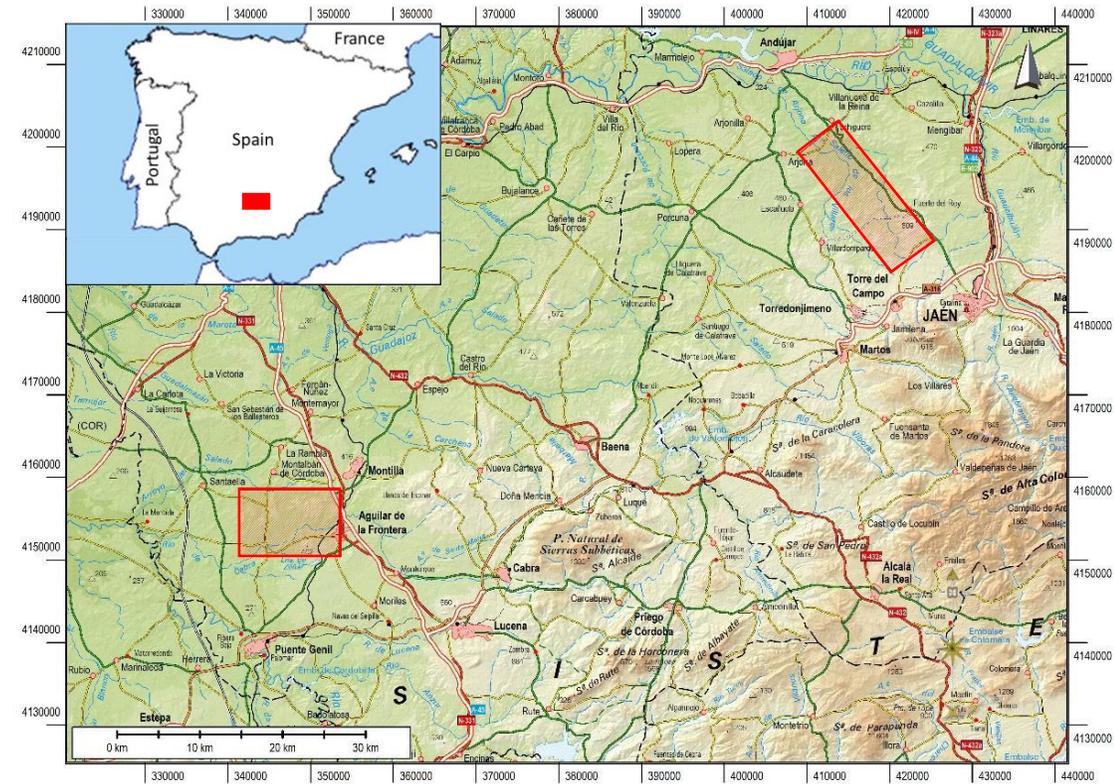
Challenge

Erosion is one of the world's most important environmental problems, with strong socio-economic implications.

- 54% of the world's agricultural area is currently affected by erosion.
- This project focuses on erosion processes in the Mediterranean area where steep slopes, low vegetation cover -very dry summers- and rainfall concentrated in short periods can cause losses of between 25 and 47 Tm of soil per ha per year.
- Quality geospatial information is essential for the monitoring process over time.

Need of 3D high-quality geospatial information for monitoring

- Use of the 3D capabilities of Pleiades Neo imagery.
- Basic products: Orthoimagery + 3D point cloud (XYZ+radiometric information for to improve classification)



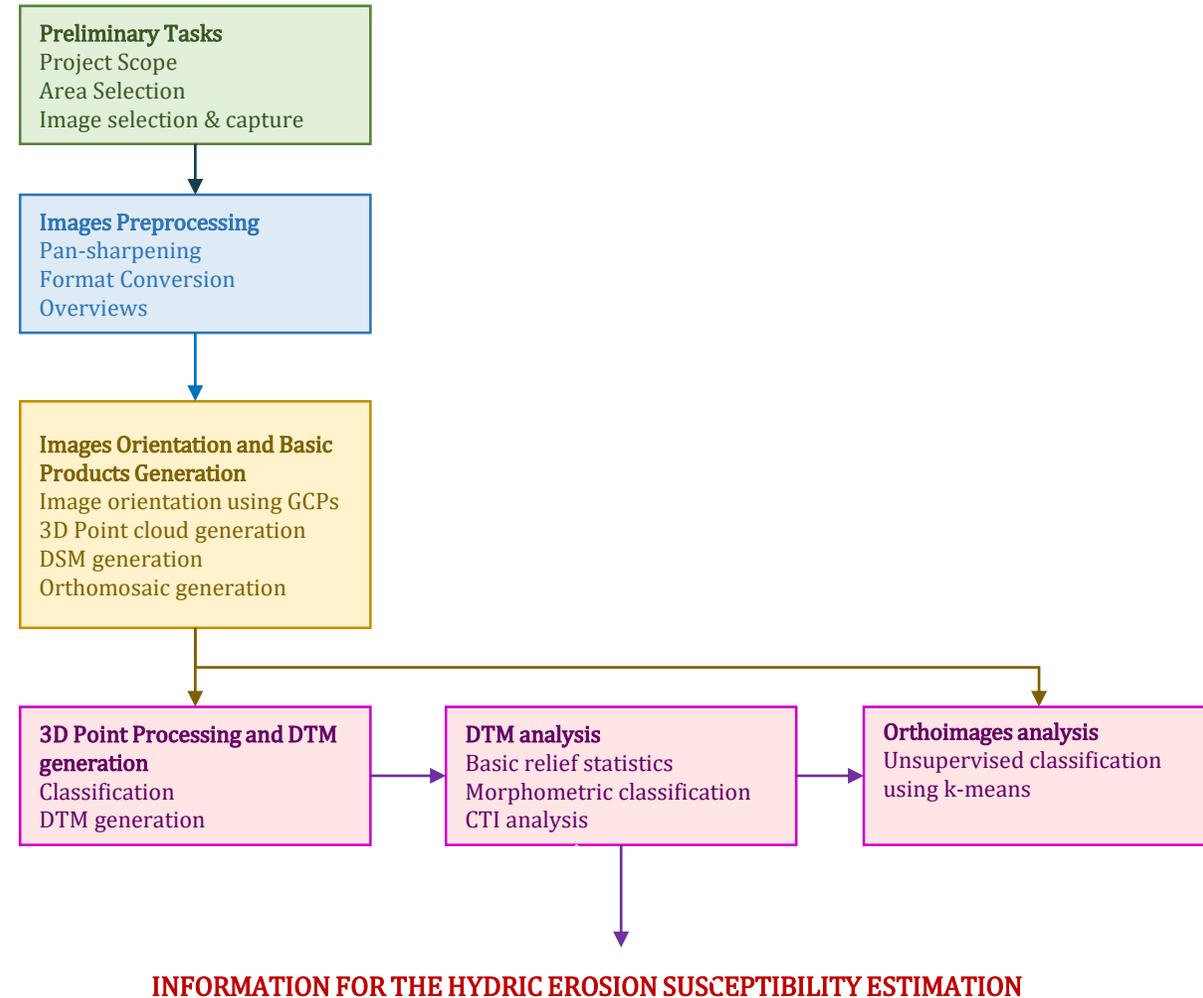


Methodology

Our methodology proposal is based in 6 main tasks

- Preliminary tasks oriented to define scope and information selection.
- Imagery preprocessing including pan-sharpening, format conversion, etc.
- Image orientation using GCP and product generation DSM and orthoimagery
- 3D Point processing (classification) for DTM generation
- DTM morphometric analysis
- Orthoimages analysis (unsupervised classification)

Finally, all of our products are compared with the corresponding ones obtained from “conventional” available geographical information (captured each 3-5 years in our region).





Solution & Results

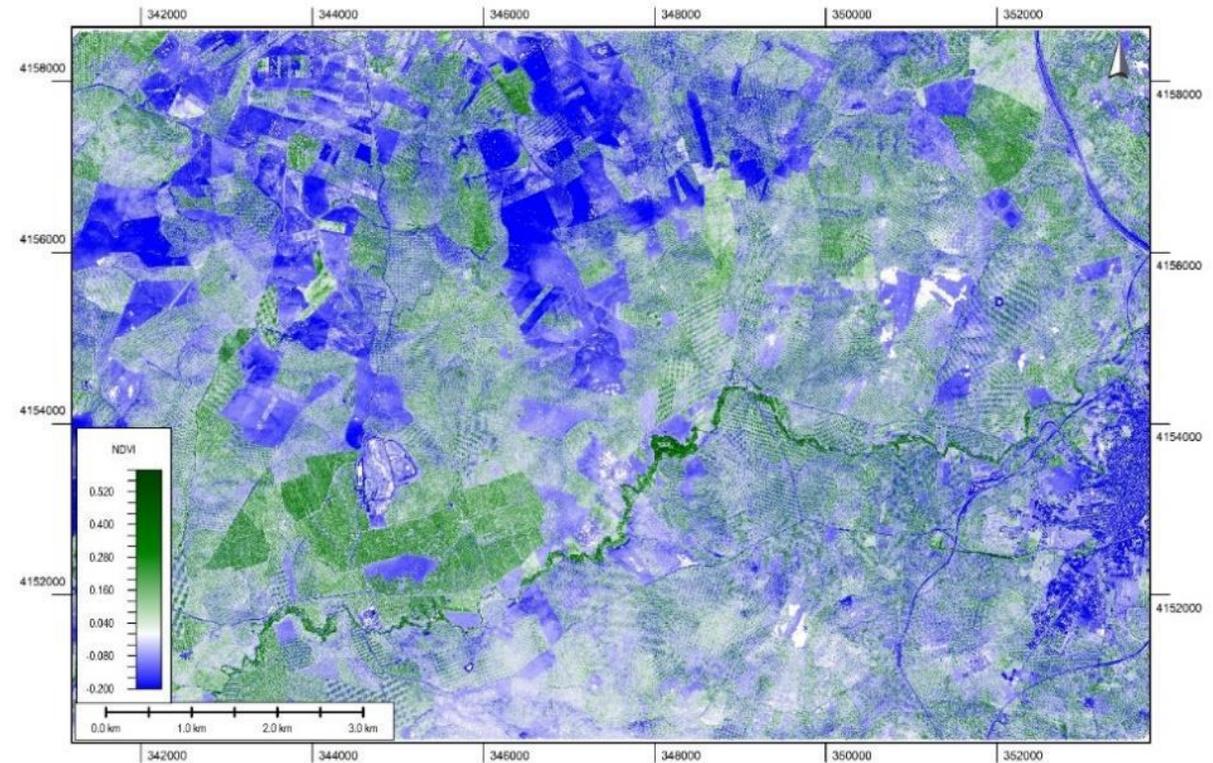
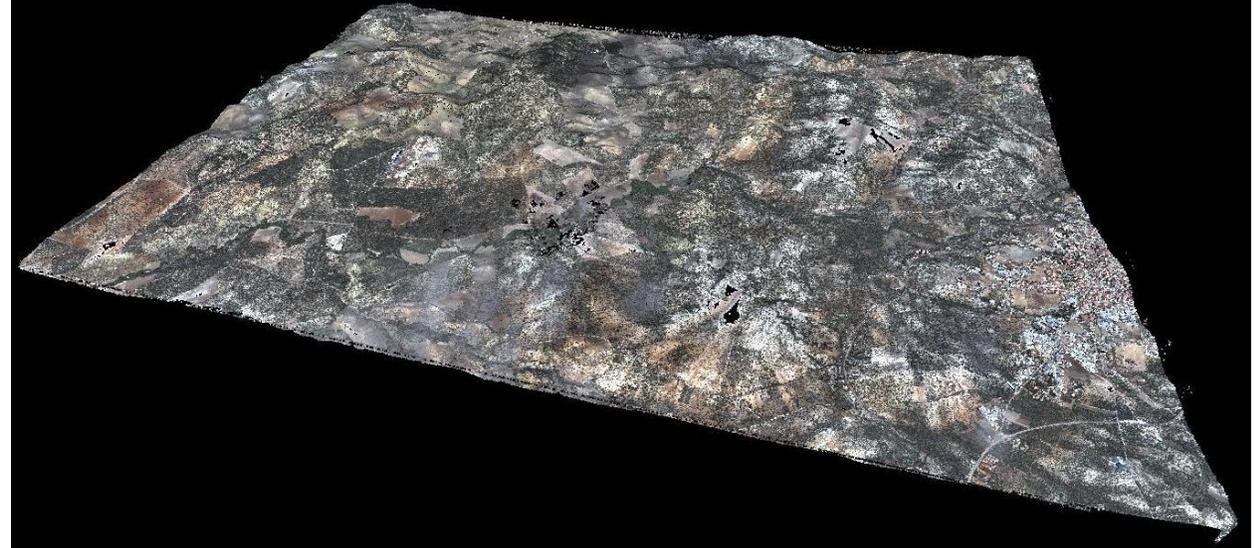
- **Excellent image quality. Visualization (and the possibility of 3D vectorization) are elements of great interest for this type of studies.**
- **Possibility of extracting 3D point clouds by applying SfM methods with a spacing approximately equal to the GSD of the image.**
- **+ 100,000,000 3D points obtained in the Cordoba study area. Excelent**





Solution & Results

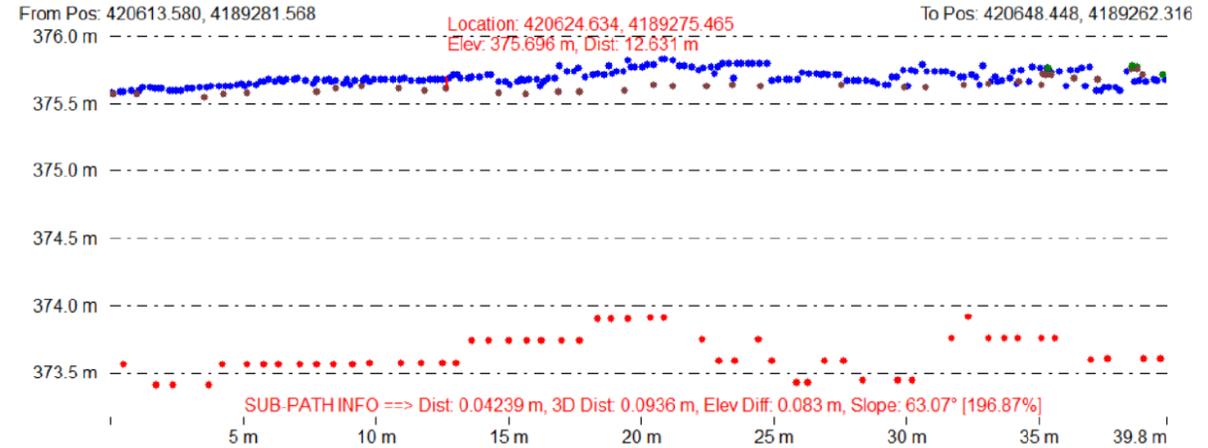
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Solution & Results

- The software used for data processing is a key factor in ensuring the quality of the results.
- If Socet GXP is considered- it can be concluded that the generated point clouds have M3C2 distances (distance between the normals to the local planes of the points) of less than 0.25m in about 40 to 60% of the points.
- These results are very interesting considering the area covered and the number of points generated.
- In any case, it is also necessary to consider that 2 years have passed since the last LiDAR campaign, and some changes in the vegetation of the area may have occurred.



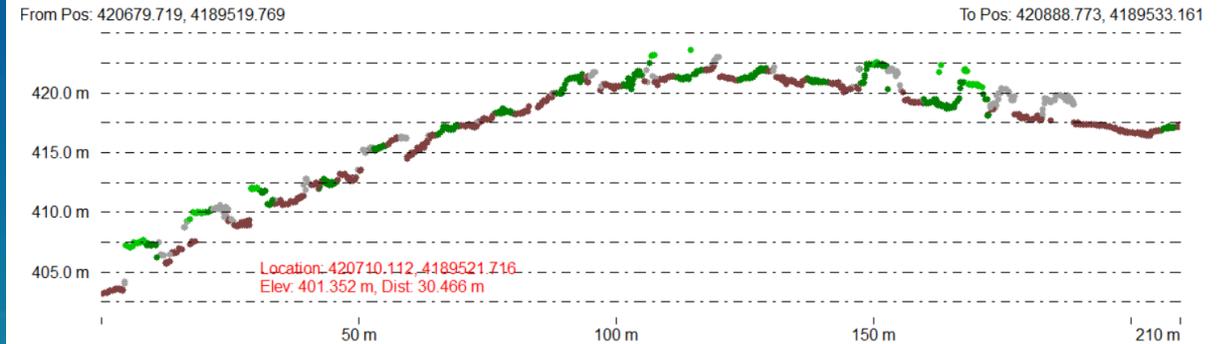
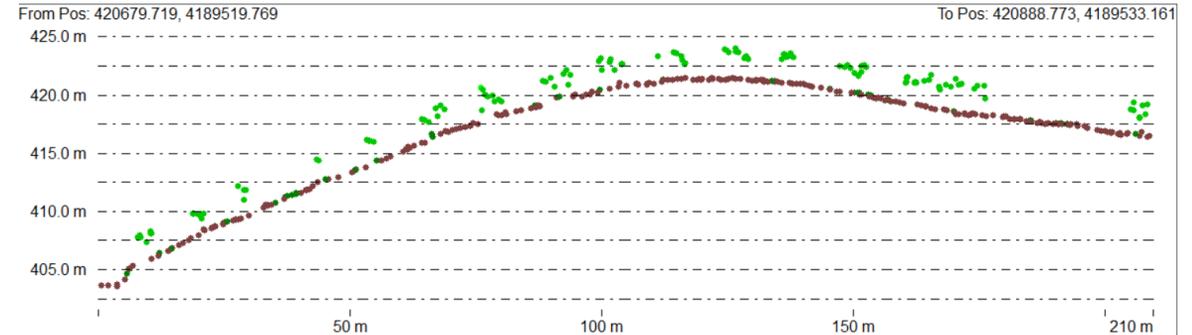
| Córdoba Zone | | | | | | | | | |
|--------------|-------------------------------|-----------|---------------|---------|---|--------|--------|--------|--------|
| | Point-to-point cloud distance | | M3C2 distance | | | | | | |
| Software | Mean(m) | StdDev(m) | Mean(m) | Std (m) | % of points with absolute distances lower | | | | |
| | | | | | 0.1m | 0.25m | 0.5m | 0.75m | 1m |
| GXP | 0.52 | 0.38 | -0.26 | 0.75 | 16.04% | 40.03% | 68.88% | 85.78% | 92.46% |
| Metashape | 1.52 | 0.71 | 1.84 | 1.10 | 0.23% | 0.61% | 1.68% | 4.32% | 10.77% |

| Jaén Zone | | | | | | | | | |
|-----------|-------------------------------|-----------|---------------|---------|---|--------|--------|--------|--------|
| | Point-to-point cloud distance | | M3C2 distance | | | | | | |
| Software | Mean(m) | StdDev(m) | Mean(m) | Std (m) | % of points with absolute distances lower | | | | |
| | | | | | 0.1m | 0.25m | 0.5m | 0.75m | 1m |
| GXP | 0.53 | 0.52 | 0.04 | 0.41 | 27.40% | 60.63% | 87.70% | 95.37% | 97.78% |
| Metashape | 1.84 | 0.90 | -2.06 | 0.75 | 0.04% | 0.11% | 0.28% | 0.71% | 1.90% |



Solution & Results

- The quality of the generated digital models – digital surface model and digital terrain model- (with a 0.5m spacing) is really good.
- Around 50% of the generated models have error lower than 0.4-0.5m in height.



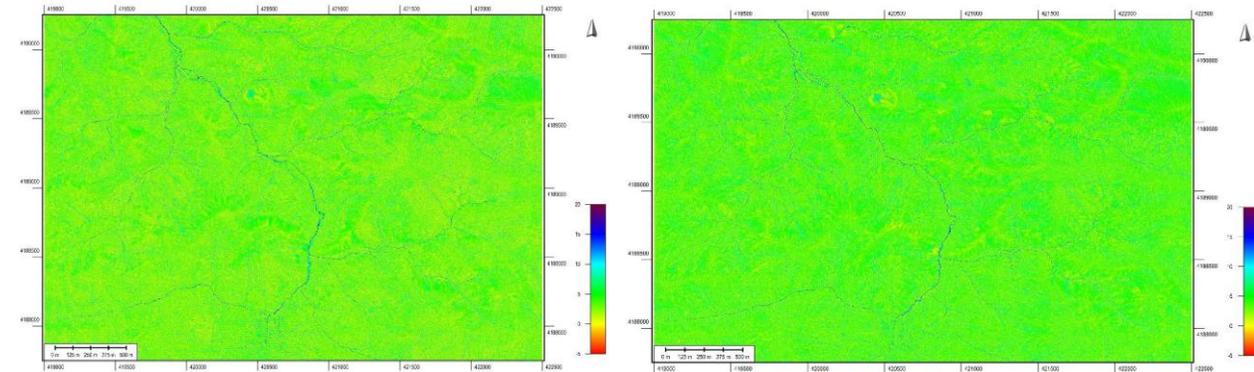
| Zone | Model | Mean (m) | Std.Dev.(m) | IQR (P75-P25) (m) | P90-P10 (P90-P10) (m) |
|---------|-------|----------|-------------|-----------------------|-----------------------|
| Córdoba | DSM | -0.17 | 0.88 | 0.58 (-0.48, 0.10) | 1.5 (-0.84, 0.66) |
| | DTM | -0.13 | 0.50 | 0.48 (-0.41, 0.07) | 0.98 (-0.61, 0.37) |
| Jaén | DSM | 0.07 | 0.83 | 0.58 (-0.21, 0.36) | 1.78 (-0.8, 0.98) |
| | DTM | 0.19 | 0.46 | 0.43 (-0.07, 0.35) | 0.92 (-0.24, 0.68) |



Solution & Results

- The results obtained from the derived models (for example, L-S factor) or drainage network delimitation are similar if they are compared with the obtained from LiDAR data.

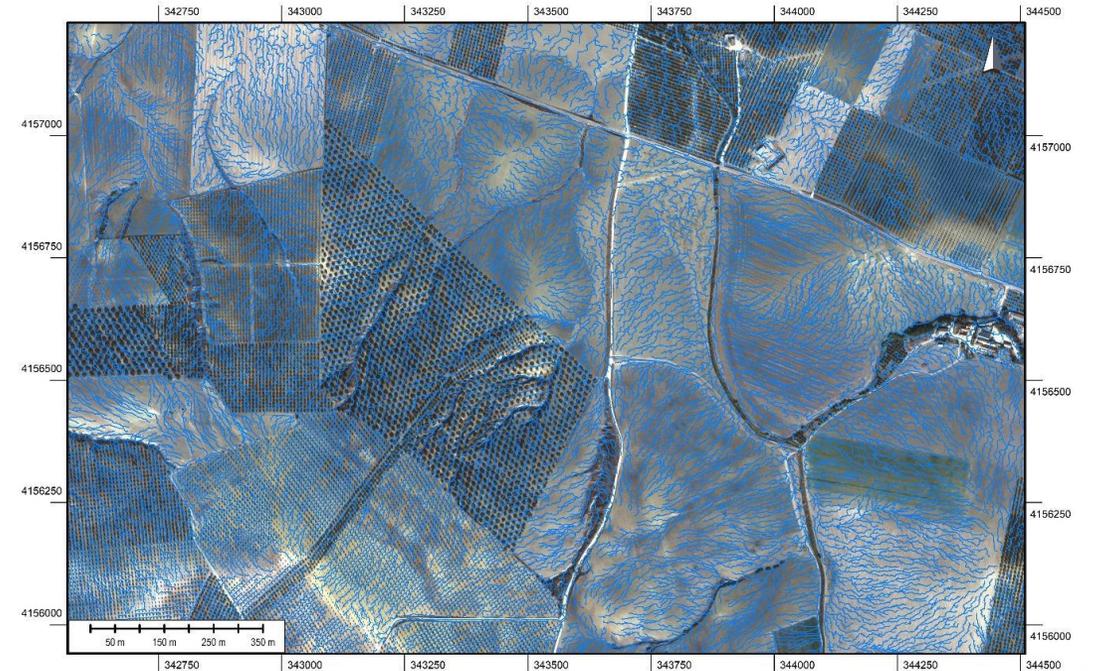
LS-factor



LiDAR

Pleiades-Neo

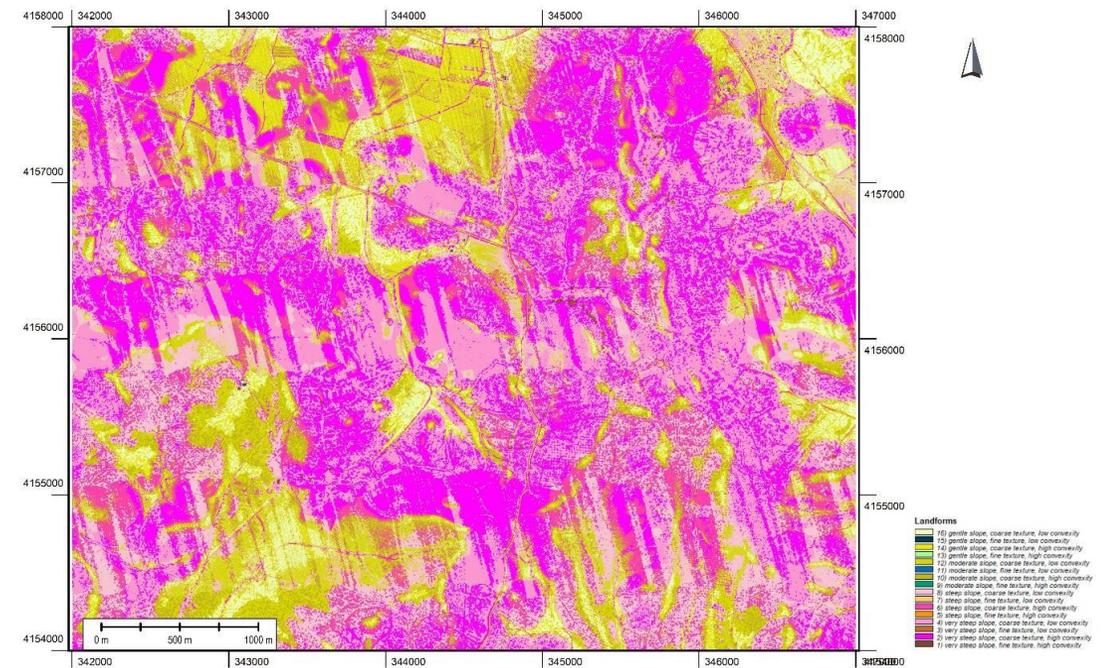
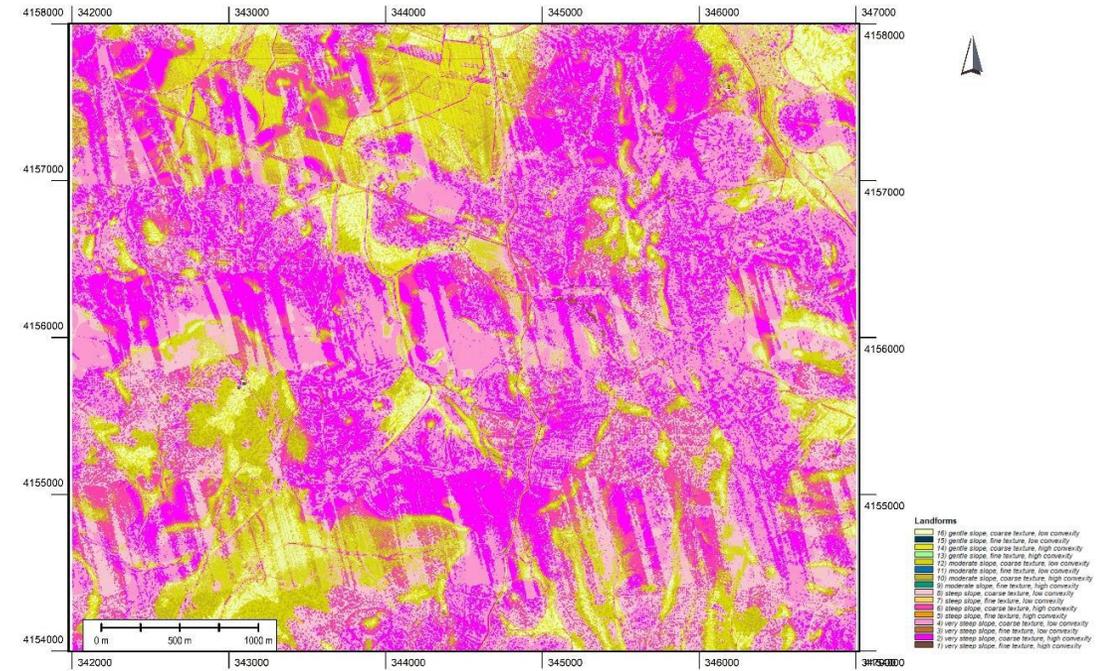
Drainage network





Solution & Results

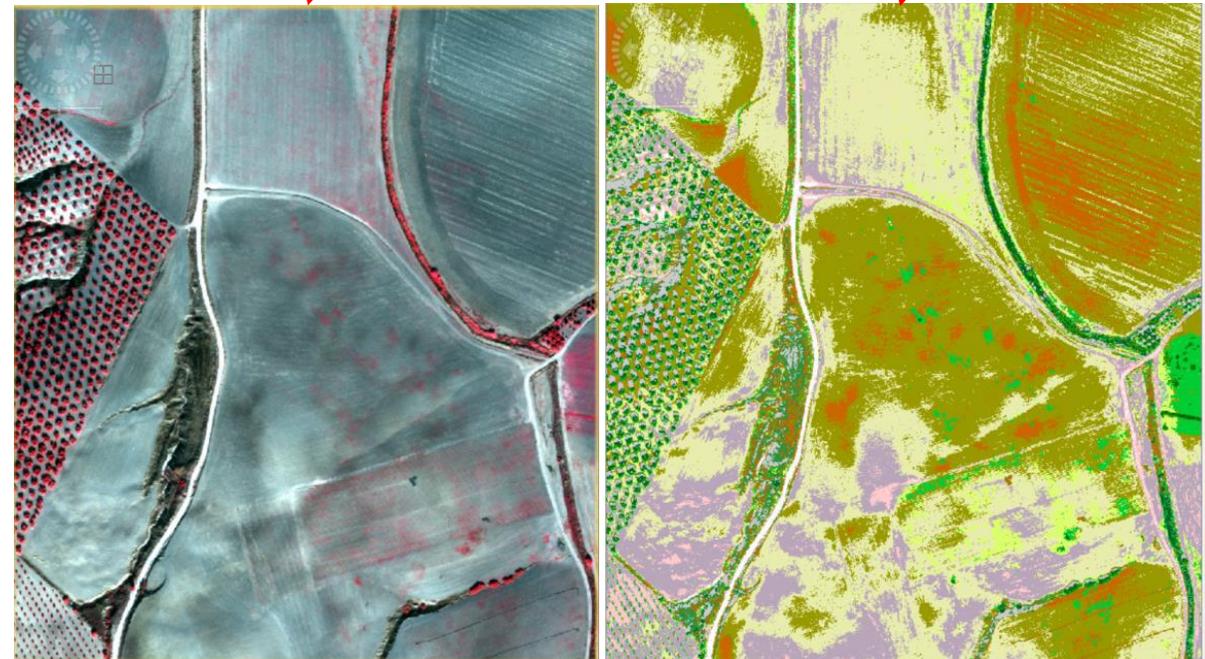
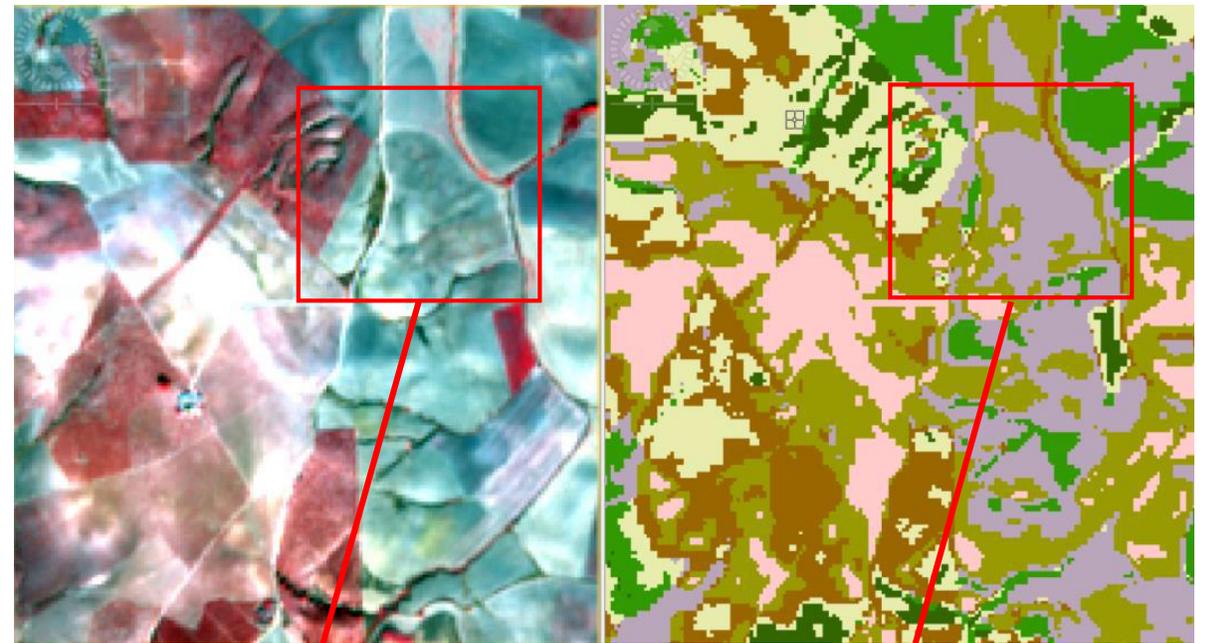
- The results obtained from the automatic classification processes are similar if they are compared with the obtained from LiDAR data.





Solution & Results

- Thanks to its very-high spatial resolution opens new possibilities in well-known remote sensing procedures, such as, classification.
- Classification could descend from the parcel-level to the tree-level.
- Different problems related with erosion processes are visible in the images, and could be classified.





Solution & Results

- **Very-high resolution images allow to calculate vegetation index, where the status of the different plant is perfectly visible (even, for high density plantation crops !!!).**





Benefits

- Easy access to information that can complement national cartographic databases.
- Ability to cover large areas with very high resolution images in a fast way (same shot).
- Ability to obtain 3D information.
- Adequate cost, although perhaps the minimum area to be acquired for this type of resolution is excessively high when working on new captures.
- The improvement of the spatial resolution of the images undoubtedly opens up great possibilities in this field.
- In any case, it is important to point out that it is considered basic to have the necessary computer resources, being necessary to contrast the results with previously contrasted information.

Organisations Involved:

