University of Western Brittany, National and kapodistrian University of Athens and Normandie University

*Zoé Bessin, **Pauline Letortu***, Marion Jaud, Niki Evelpidou, Emmanuel Vassilakis, Christophe Delacourt, Stéphane Costa*

*Lecturer in Geography

Our universities work on marine and coastal sciences and technologies

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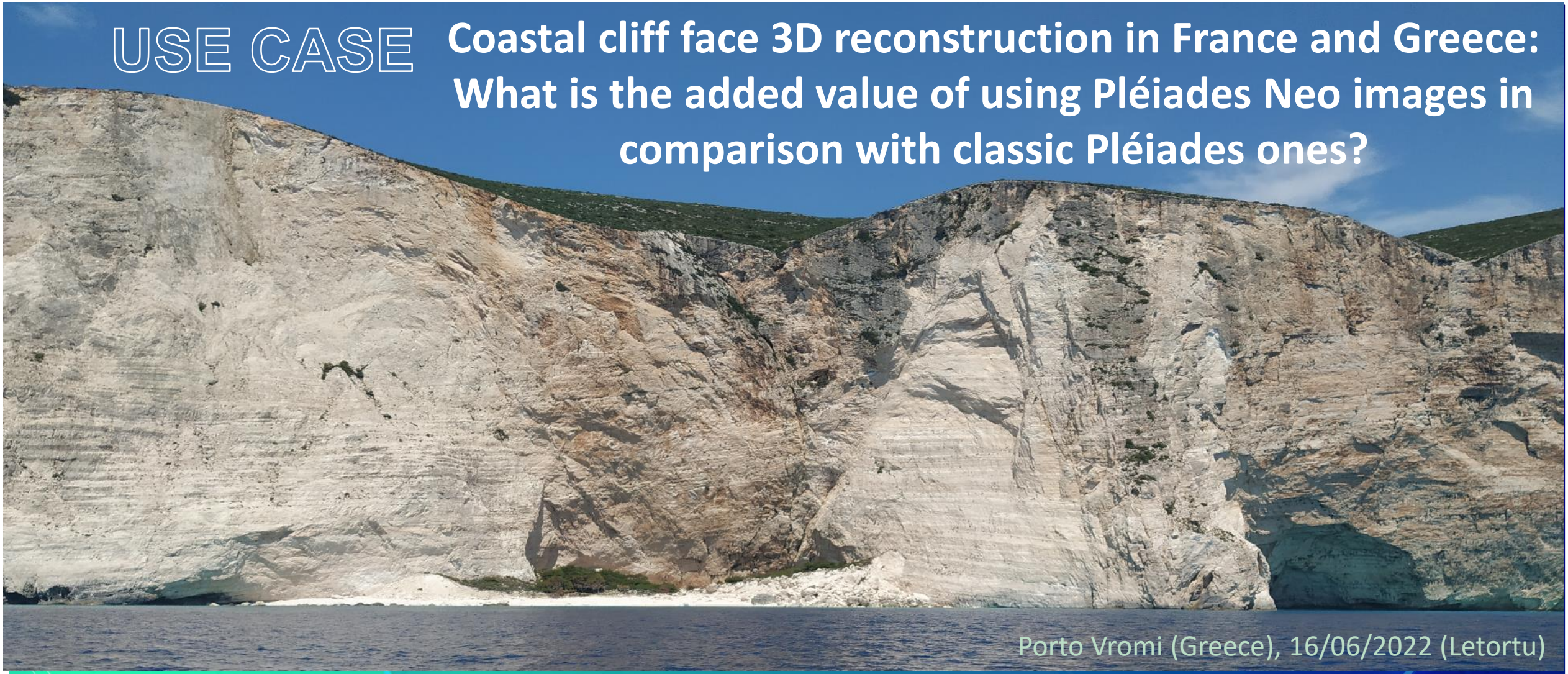
USE CASE

Coastal cliff face 3D reconstruction in France and Greece: What is the added value of using Pléiades Neo images in comparison with classic Pléiades ones?



Porto Vromi (Greece), 16/06/2022 (Letortu)

Application: Hazard Monitoring
Location: France (Brittany) and Greece (Zakynthos Island)
Products: Pléiades and Pléiades Neo

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Challenge

Parts of the coasts of Brittany and Zakynthos Island are characterized by cliffs which retreat fast with many rock falls

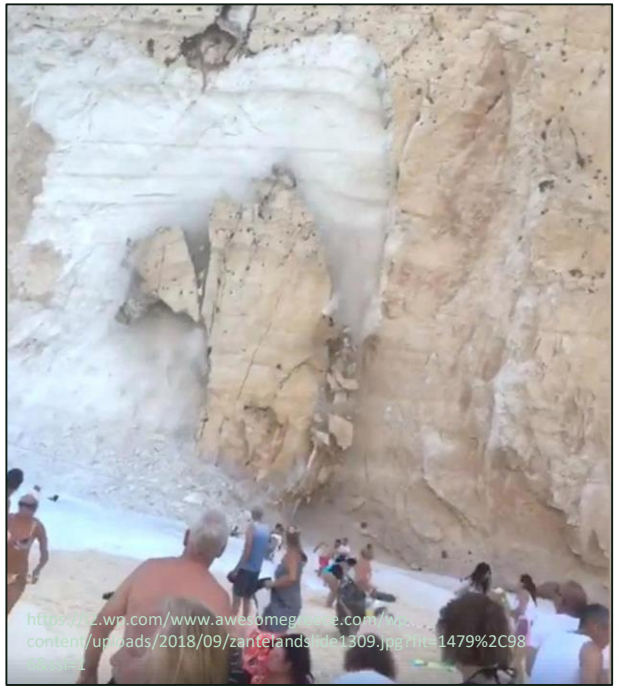
- Coastal erosion hazard threatens populations, infrastructure and local economy
- Coastal managers request information about retreat rates, rhythms and modalities of erosion to set up relevant coastal management and coastal planning
- To do so, scientists need for data in 3D of the cliff face, at very high spatial resolution (VHSR), over large scales and with high repetitiveness

Pléiades Neo (resolution of 0.3 m at nadir) can provide this:

- Scientists reconstruct cliff face in 3D based on oblique and VHSR images and collect retreat rates, rhythms and modalities of erosion
- These results help coastal managers in decision-making

Navagio (Zakynthos Island), 16/06/2022 (Letortu)

Rock fall in the touristic beach of Navagio

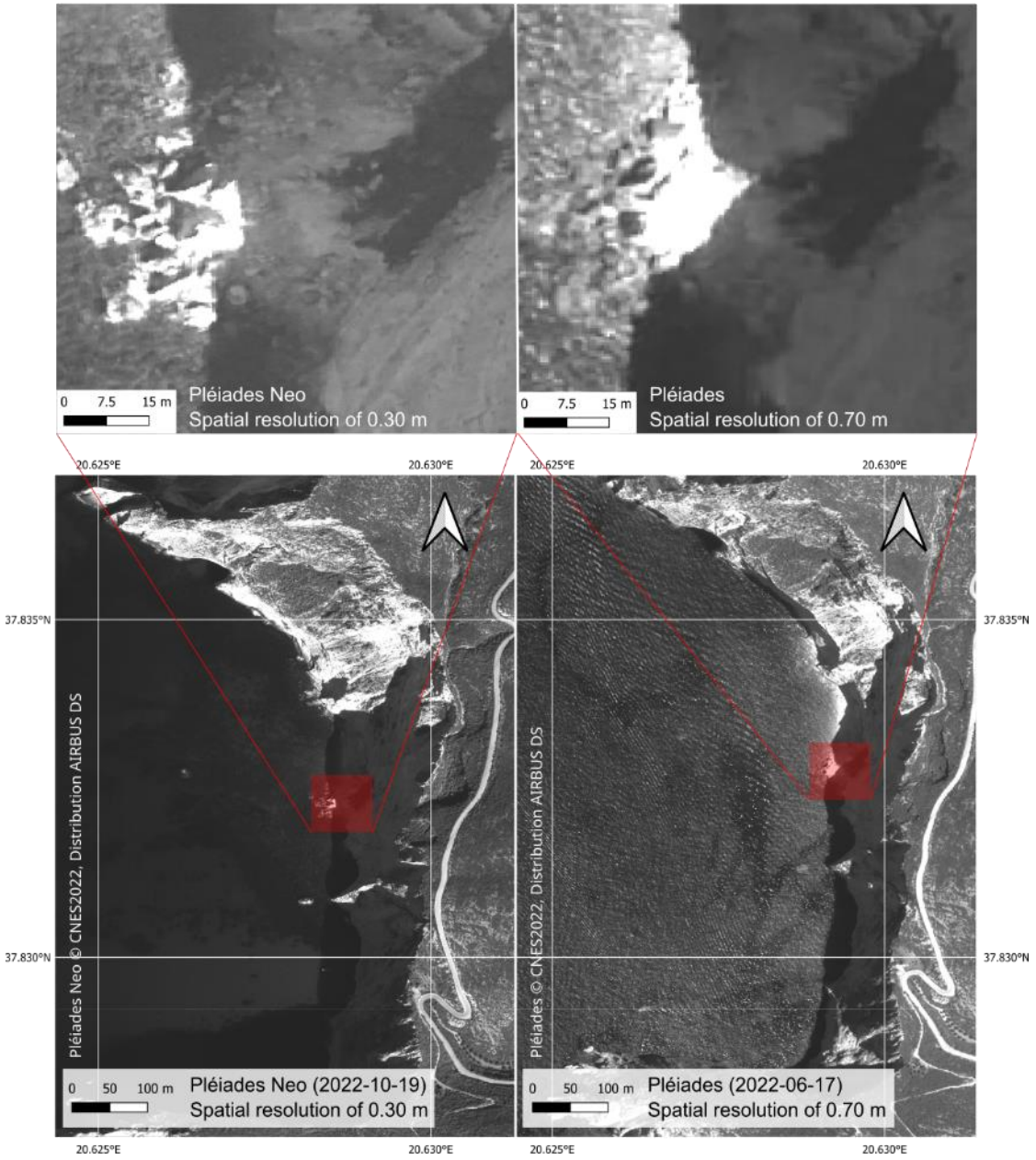


Solution & Results

- Tristereo acquisition mode with oblique angles (20-30° from the nadir) and with an orbit facing the cliff face => 3 images in France, 16 images in Greece
- In using MicMac processing chain and in comparison with classic Pléiades imagery (resolution of 0.7 m at nadir), the use of Pléiades Neo imagery :
  - makes easier to identify the erosion areas and rock falls
  - improves point density (1.3 pt/m² *vs*. 0.34) in 3D reconstruction but accuracy (4.1 m *vs.* 2.9 m) and precision (3.8 m *vs.* 1.7) are lower and the processing time with MicMac is longer (3-4 days *vs*. 1 day for 1.5 km of cliff line)
- The improvement is too slight to justify the need for a better spatial resolution for 3D reconstruction

Pléiades Neo Imagery can help to:

- **Better identify rock falls**
- **manage coastal areas if the processing chain is improved**

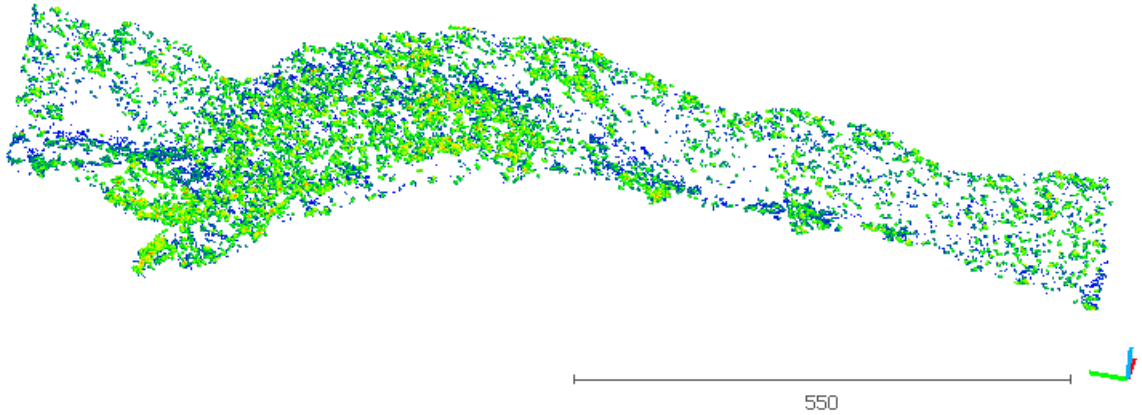


Comparison between Pléiades Neo imagery and classic Pléiades imagery on the site of Porto Vromi (Greece)

Benefits

- The use of Pléiades Neo imagery improves the identification of rock falls and the point density in the 3D reconstruction

Mesh of the cliff face in Porto Vromi in June 2022 (terrestrial photogrammetry)



3D reconstruction of the cliff face in Porto Vromi in October 2022 based on Pléiades Neo imagery with a regularization of 0.05 and a correlation window size of 2 (5x5 pixels)

Regularization parameter	Size of the correlation window	Number of points	Mesh surface (m²)	Point density (pts/m²)	Mean distance (m)	Standard deviation (m)
0.05	2 (5x5 pixels)	316 956	241 840	1.3	4.1	3.8

Point density, mean distance and standard deviation for the 3D reconstruction on Porto Vromi cliff face based on Pléiades Neo imagery (19/10/2022)

Regularization parameter	Size of the correlation window	Number of points	Mesh surface (m²)	Point density (pts.m^{-2})	Mean distance (m)	Standard deviation (m)
0.1	1 (3x3 pixels)	129 607	378 775	0.3	2.9	1.7

Point density, mean distance and standard deviation for the 3D reconstruction on Porto Vromi cliff face based on classic Pléiades imagery (17/06/2022)

Benefits

- The use of Pléiades Neo imagery improves the identification of rock falls and the point density in the 3D reconstruction
- The first tests on Metashape software are excellent about point density on the cliff face as well as time of processing (4 h for a complete Pléiades Neo image)
- Pléiades Neo data can be used for multisource detection change (cliff erosion) by deep learning (in addition to classic Pléiades images) (PhD thesis of Z. Bessin)

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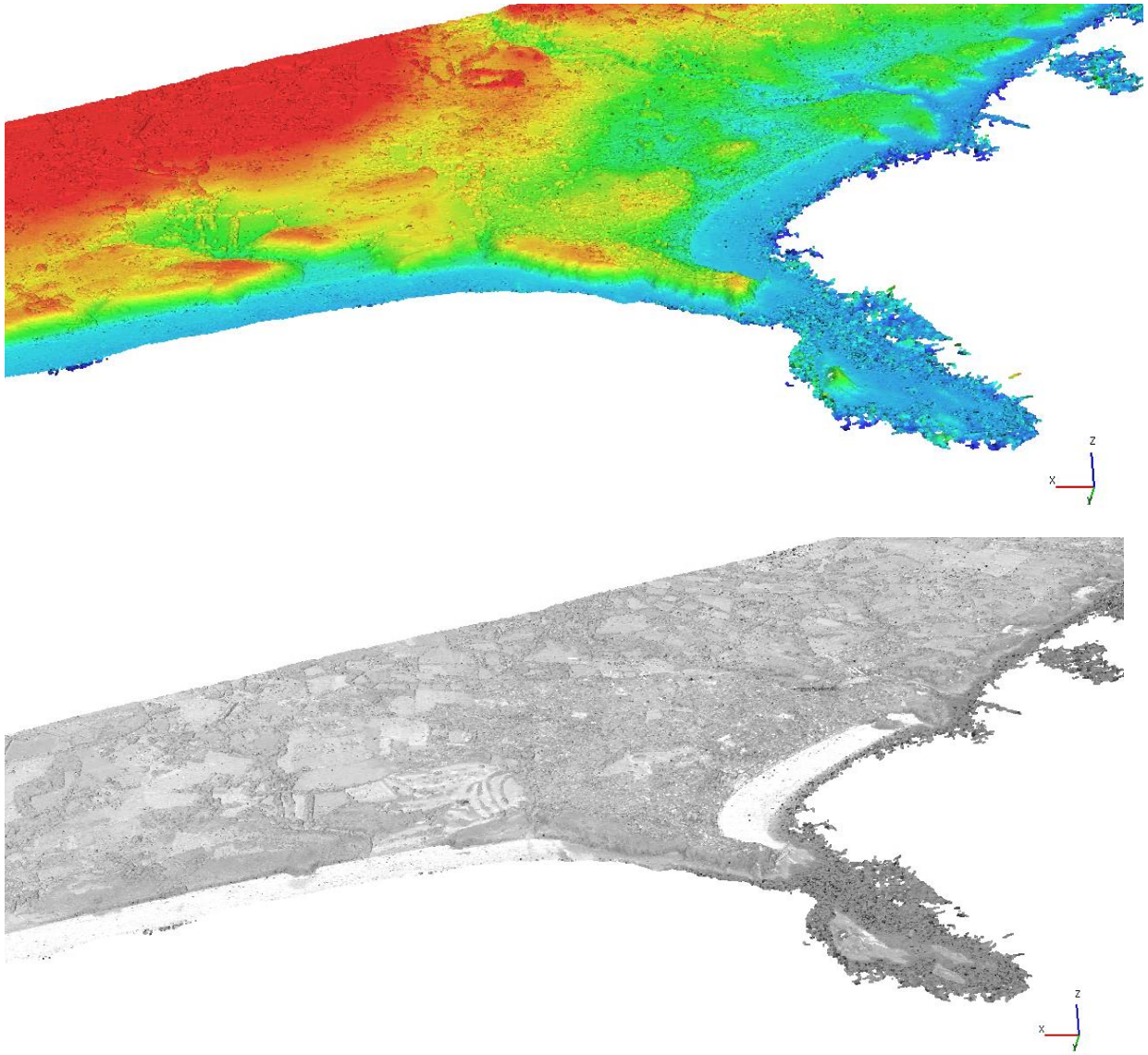

3D reconstruction of the cliff face in Pléneuf-Val-André in September 2022 based on Pléiades Neo imagery with the Metashape processing chain.