

# UAV observation of the recent evolution of the Planpincieux Glacier (Mont Blanc - Italy )

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**OCTOBER 2011**

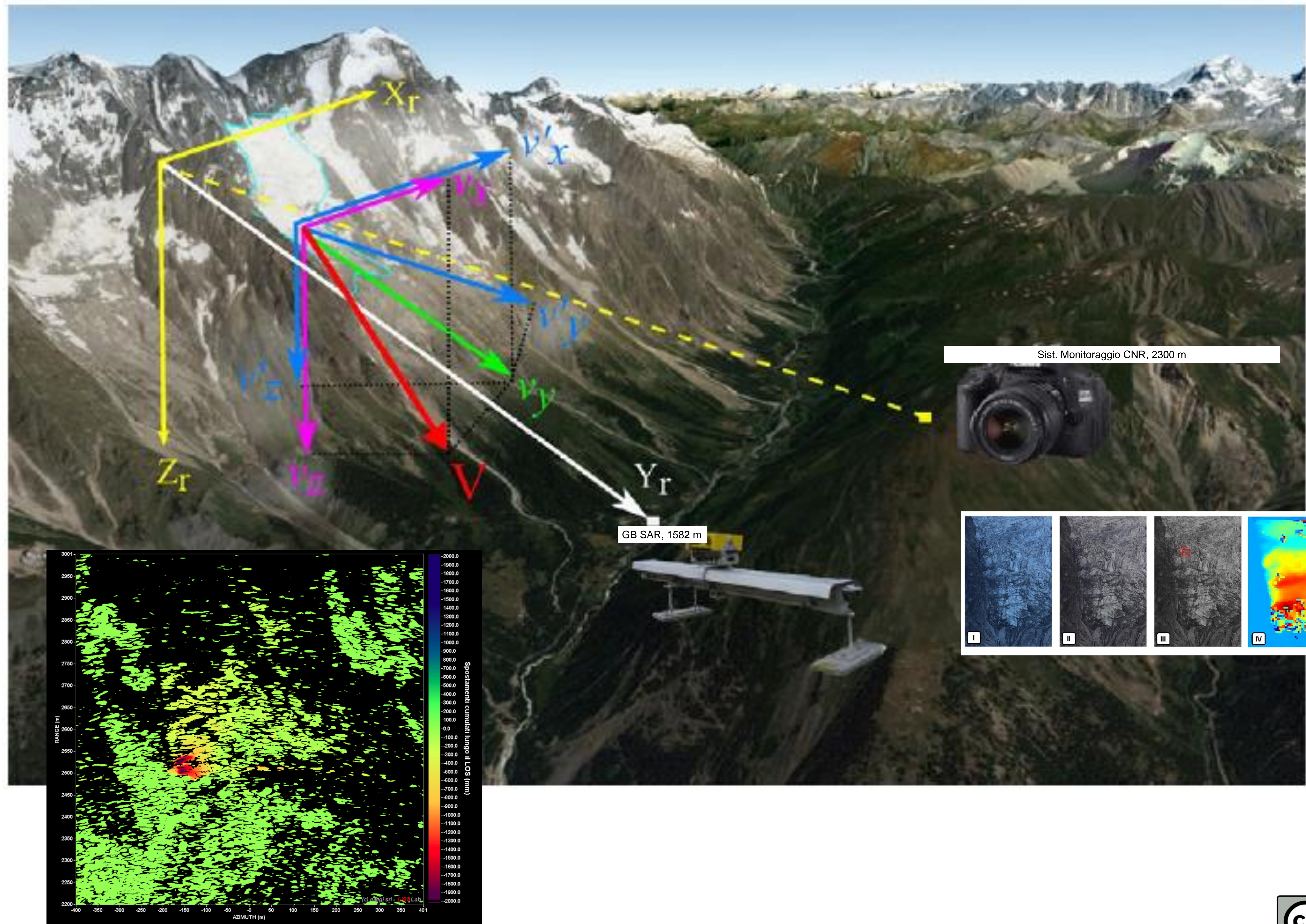
**A large anomalous crevasse  
opening was observed in the  
most active part of the glacier  
tongue**



**In 2012 it appeared  
again and FMS  
started a visual  
monitoring activity  
of the glacier  
evolution**



## Integrated ground based monitoring systems





## Coupled multi-temporal UAV and Helicopter borne Photogrammetric flights



**Very difficult access**





## Coupled multi-temporal UAV and Helicopter borne Photogrammetric flights

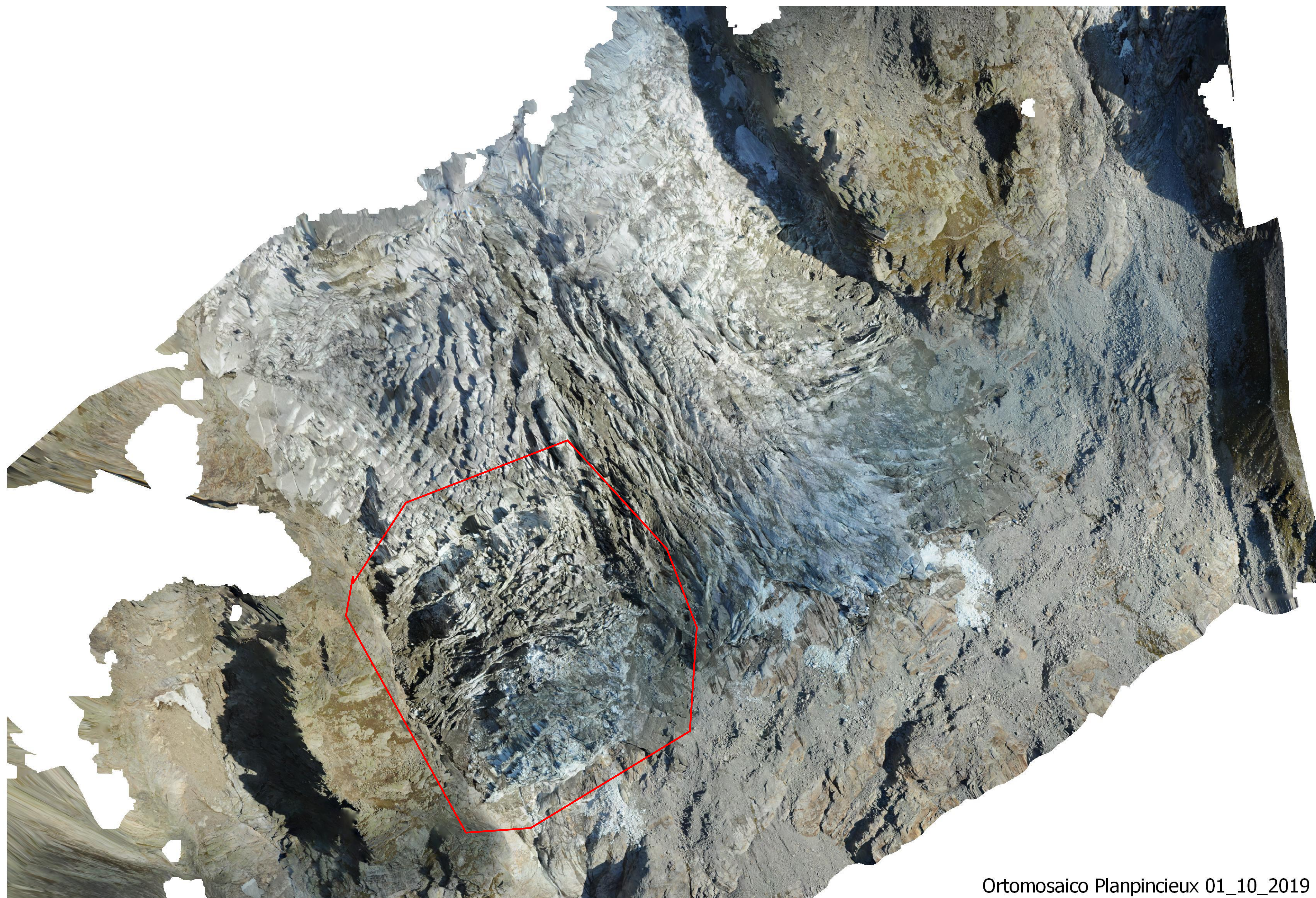
High danger of ice/debris fall



Very limited area for GCP's







Ortomosaico Planpincieux 01\_10\_2019

0 75 150 m



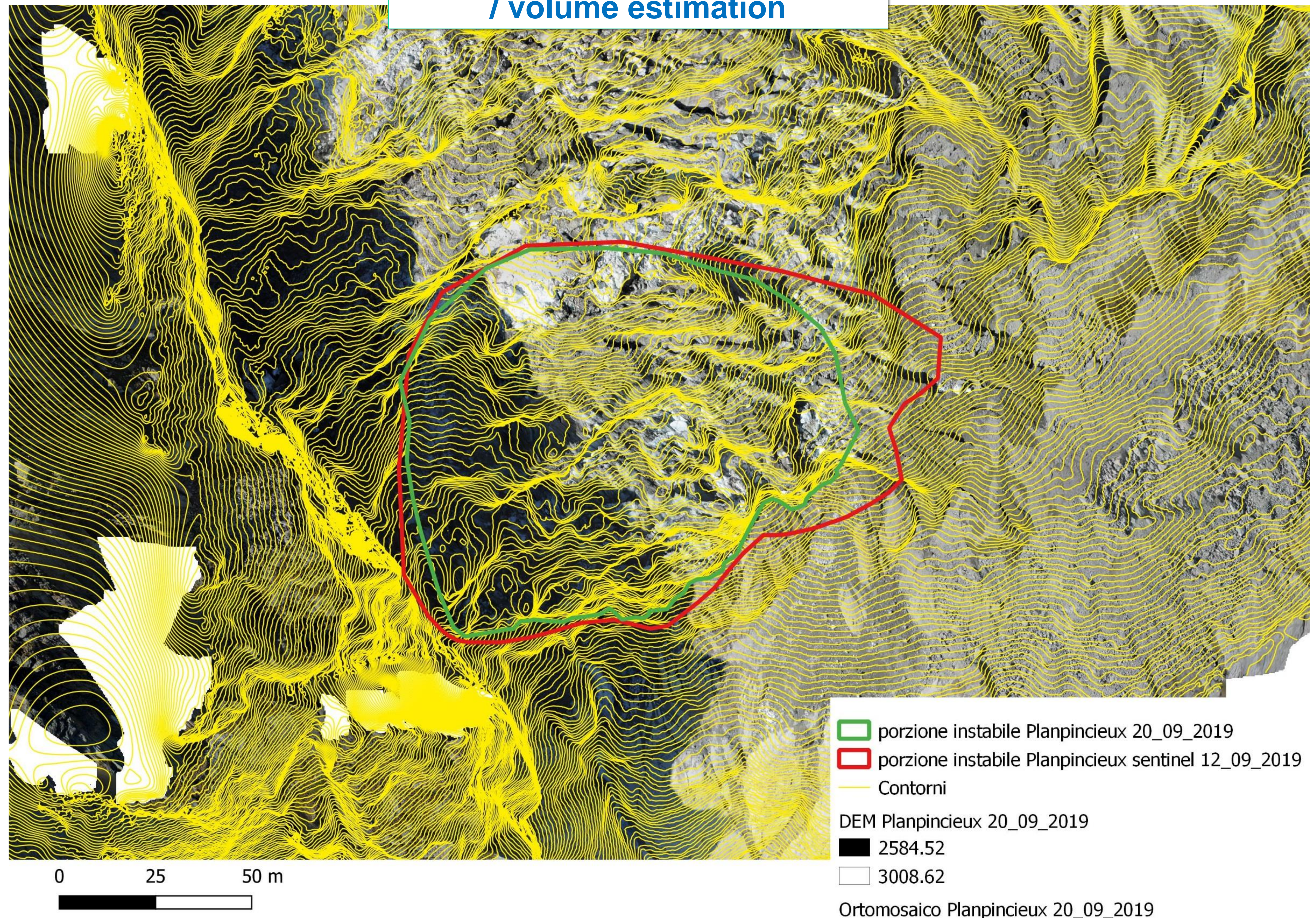


## 2019 Evolution of the Glacier: Imminent Ice avalanche risk



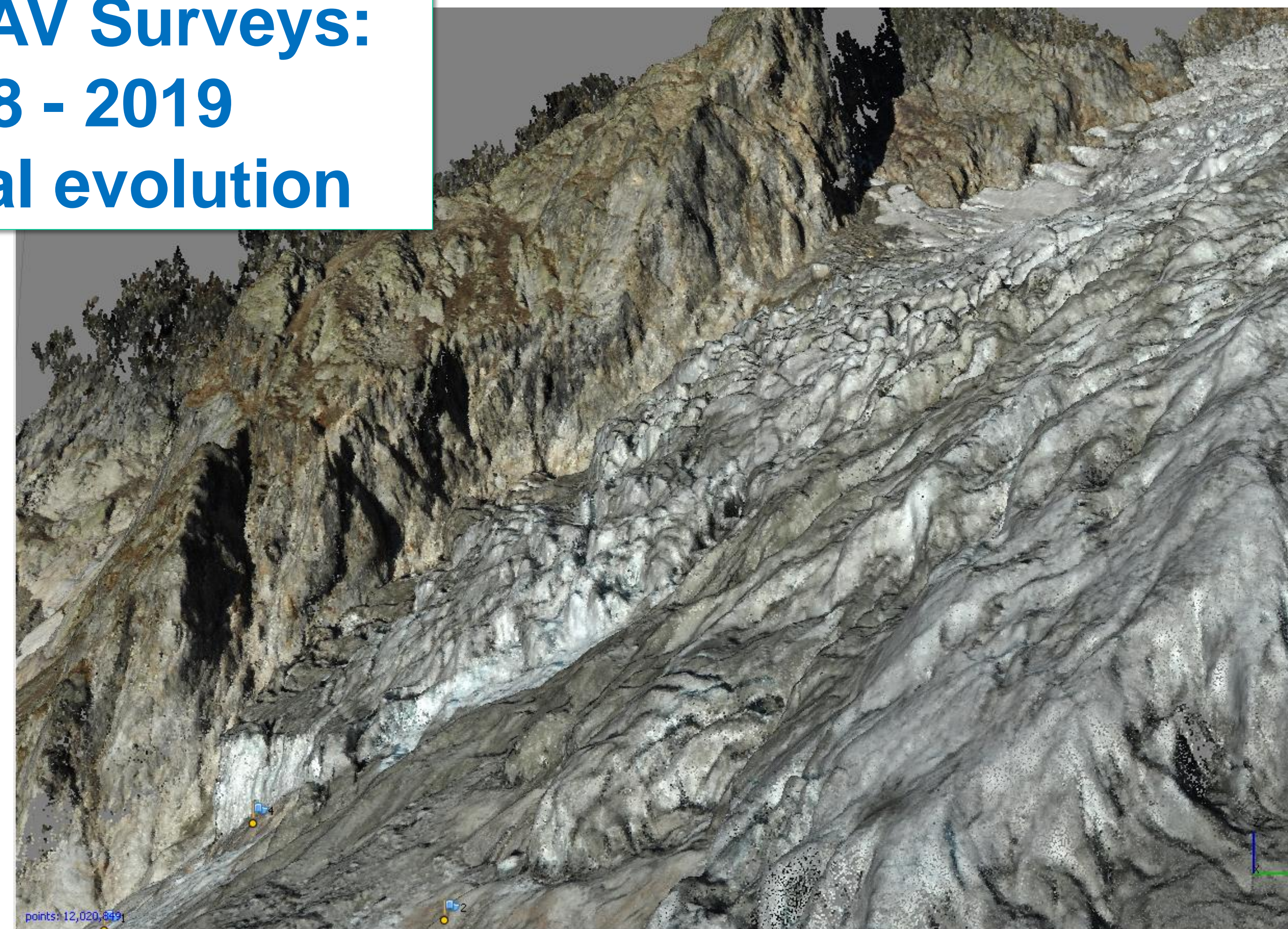
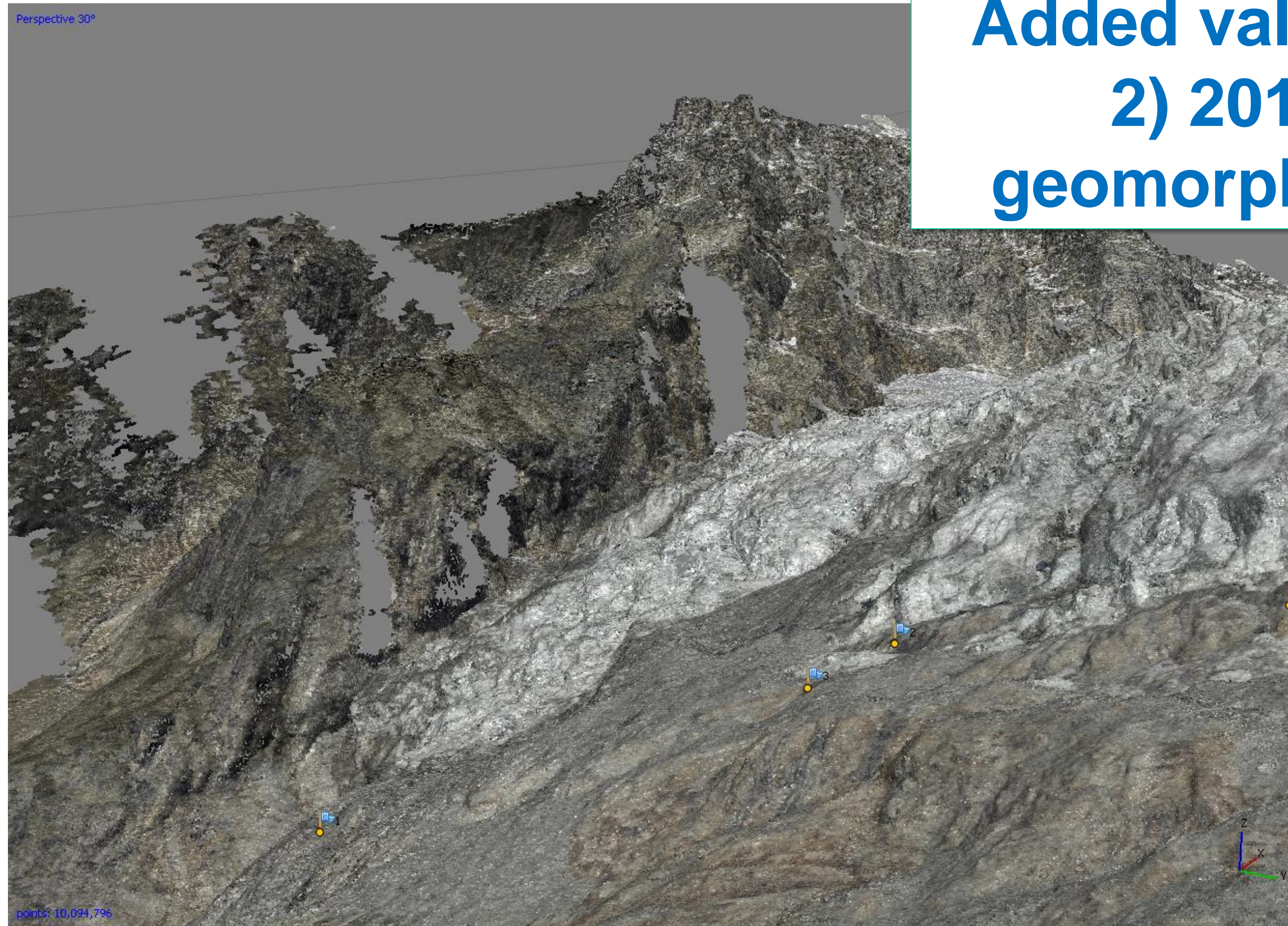


## Added value of UAV Surveys: 1) Individuation of unstable Area / volume estimation



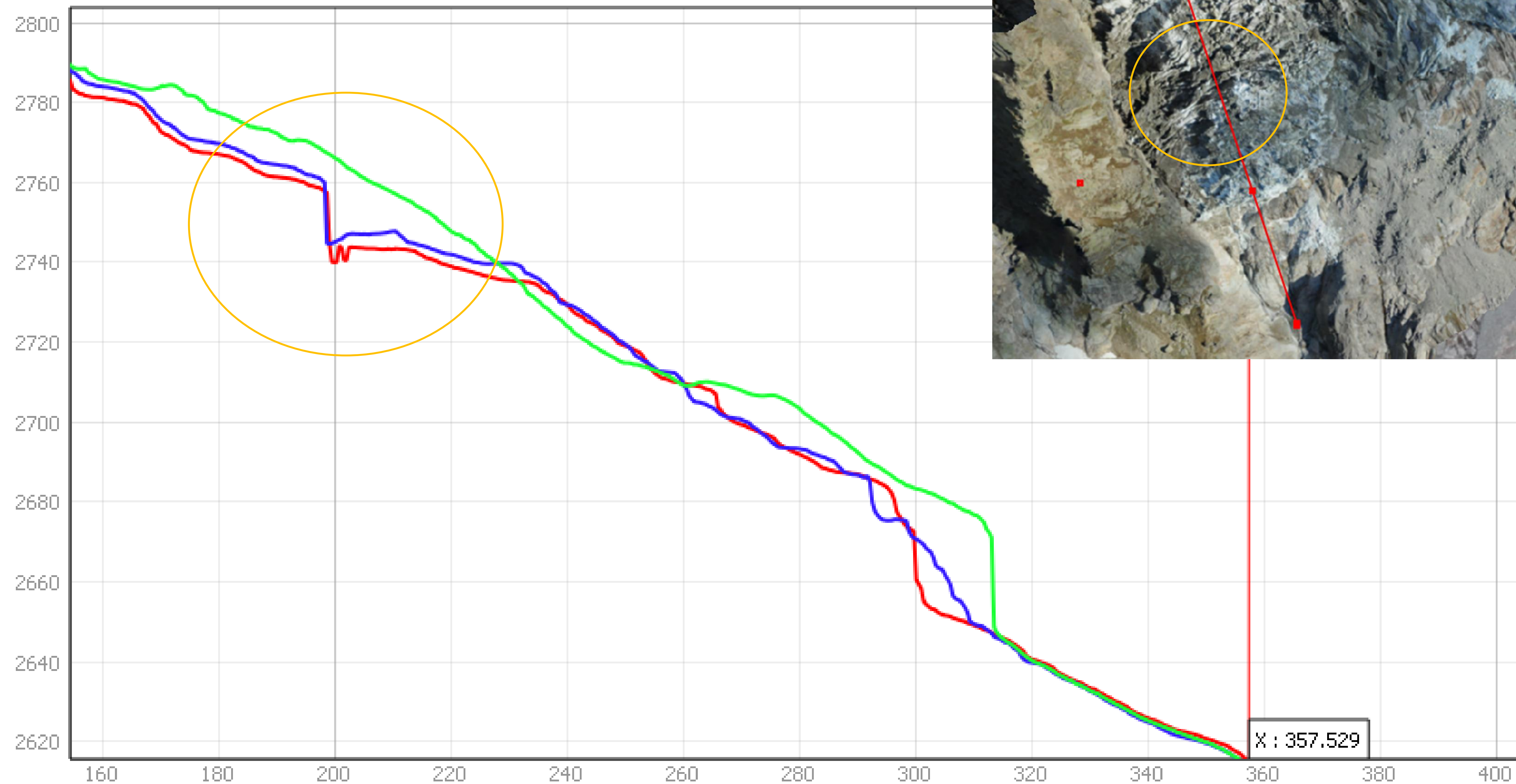


## Added value of UAV Surveys: 2) 2017 – 2018 - 2019 geomorphological evolution



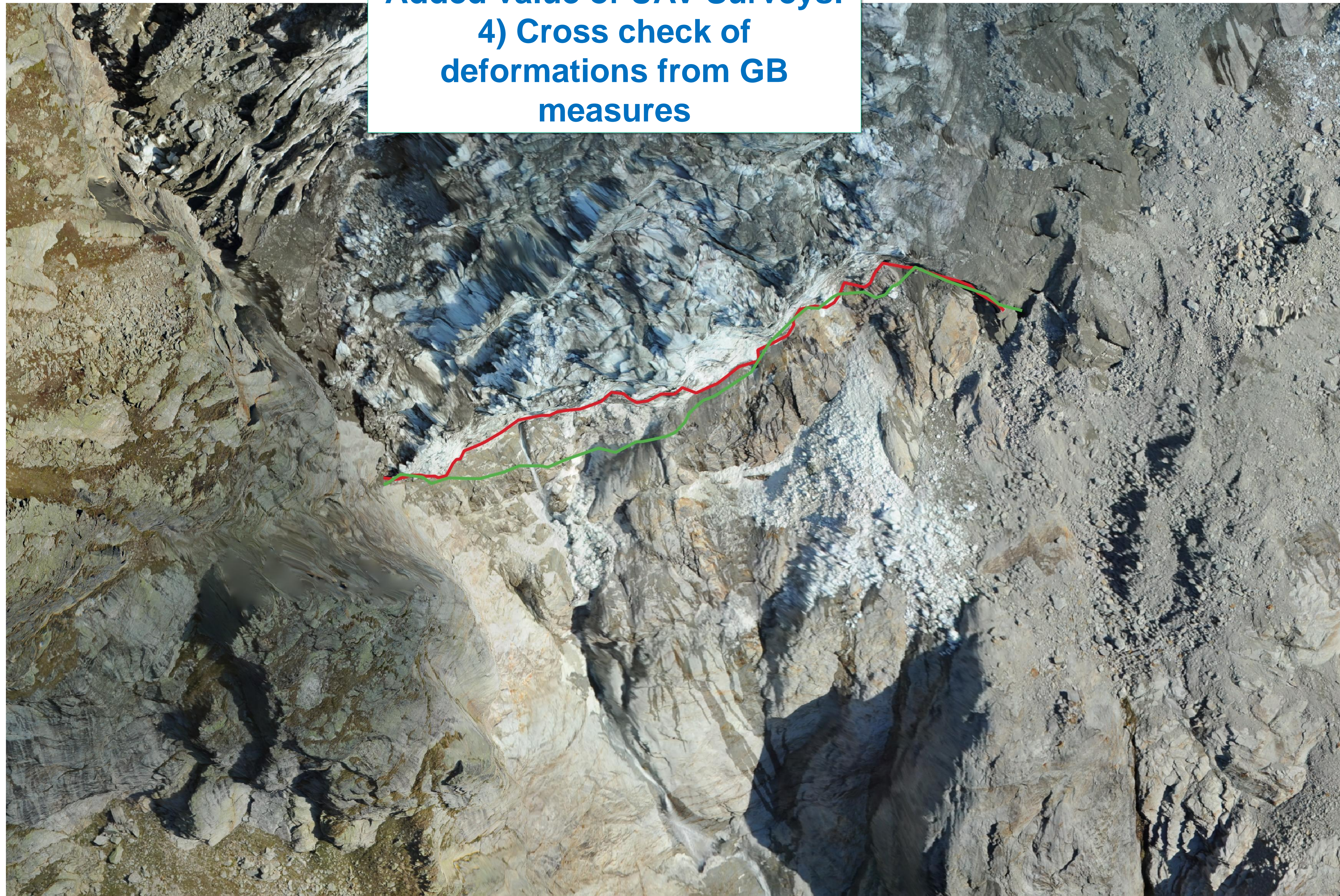


**Added value of UAV Surveys:  
3) July – September – October  
2019 topographic evolution**





**Added value of UAV Surveys:**  
**4) Cross check of**  
**deformations from GB**  
**measures**



0 25 50 m





## Added value of UAV Surveys: 4) Cross check of GPR ice thicknesses with DEM Differencing

