Suivi de mouvements gravitaires par série d'images optiques

Monitoring gravitational movements with optical image time series

50 ans de l'ADRGT

Ombeline Meric [1,2]

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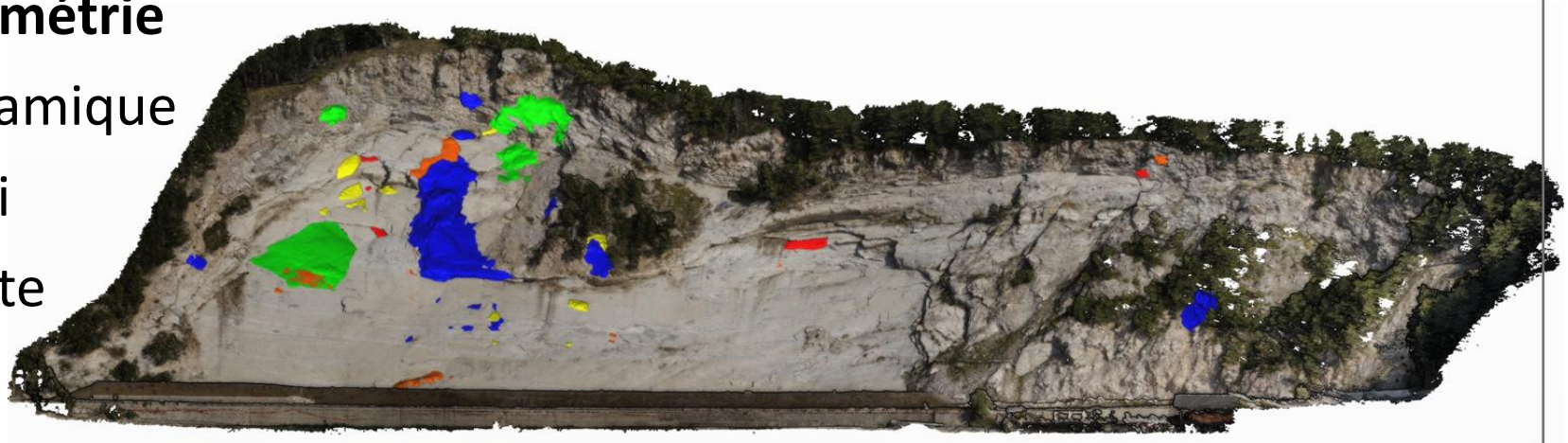
Les **systèmes d'alerte actuels** : observation du suivi de mesures, généralement **ponctuelles**, imparfaitement compte des processus de déformation.

Améliorer la caractérisation des mouvements de terrain :

- **Géométrie**
- Dynamique
- Suivi
- Alerte



En bleu : octobre 2016 et novembre 2016 ; en rouge : novembre 2016 et novembre 2017, en jaune novembre 2017 et août 2018, en orange aout 2018 et septembre 2019, en vert : septembre 2019 et septembre 2020.

100

2015 -> photogrammétrie

- Permet la quantification des volumes déplacés mais pas des mouvements

- 2015 -> photogrammétrie
  - Permet la quantification des volumes déplacés mais pas des mouvements
- 2016 -> Stage de Mathilde DESRUES en collaboration avec Pascal Lacroix et David Amitrano (ISTerre)
- 2017 -> 2020 Thèse CIFRE de Mathilde DESRUES en collaboration avec Jean Philippe Malet (ITES) : **Operational monitoring of gravitational movements with image time series**
- 2023 -> 2026 Thèse CIFRE de Bastien WIRTZ en collaboration avec JP Malet et F Provost (ITES) : **Outils de télédétection opérationnels des mouvements de terrain**

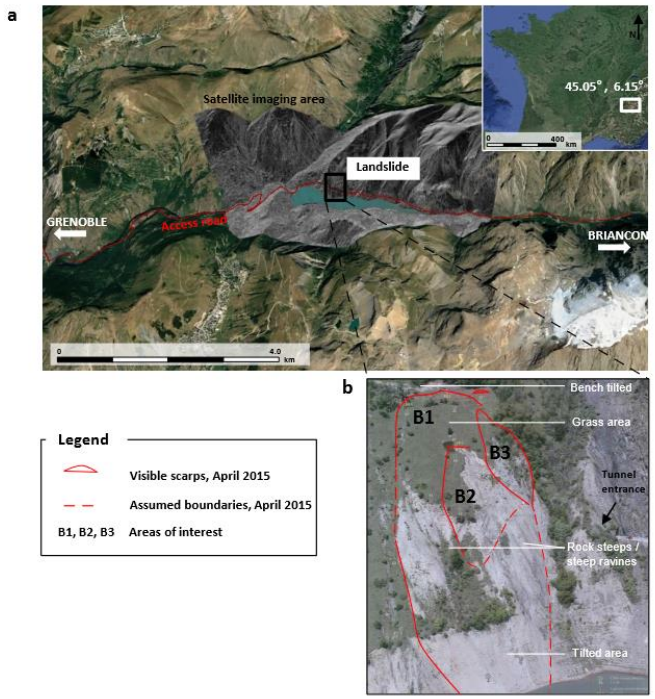
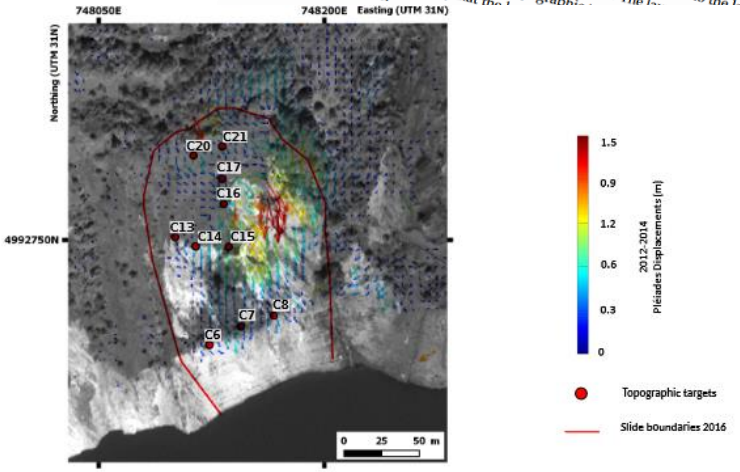


Figure 1. Landslide of the Tunnel du Chambon. **(a)** Area of study with its situation in France (source: Google Earth). The rectangular is the localization of the landslide. Shaded relief indicates the satellite imaging area used in this study. **(b)** Photography of the landslide [20].



geosciences
Article
MDPI

Satellite Pre-Failure Detection and In Situ Monitoring of the Landslide of the Tunnel du Chambon, French Alps

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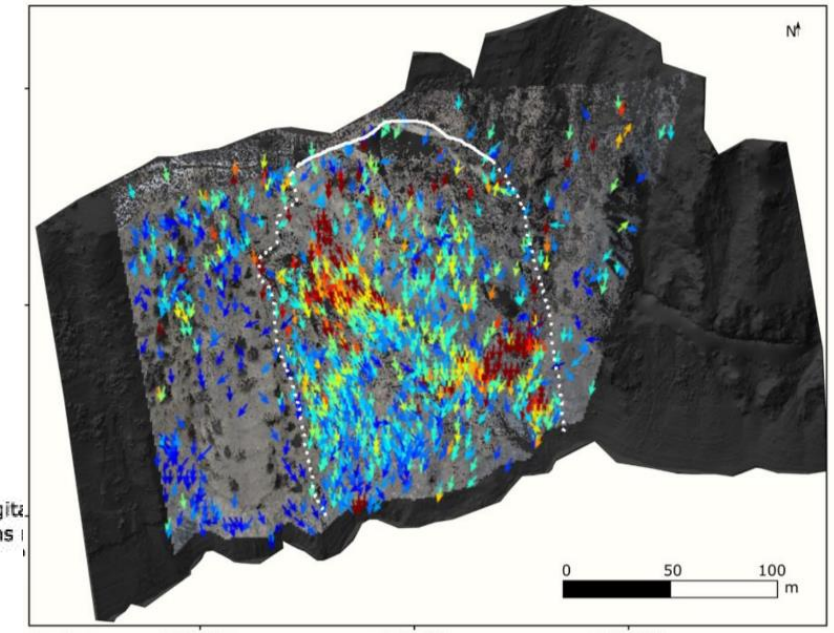
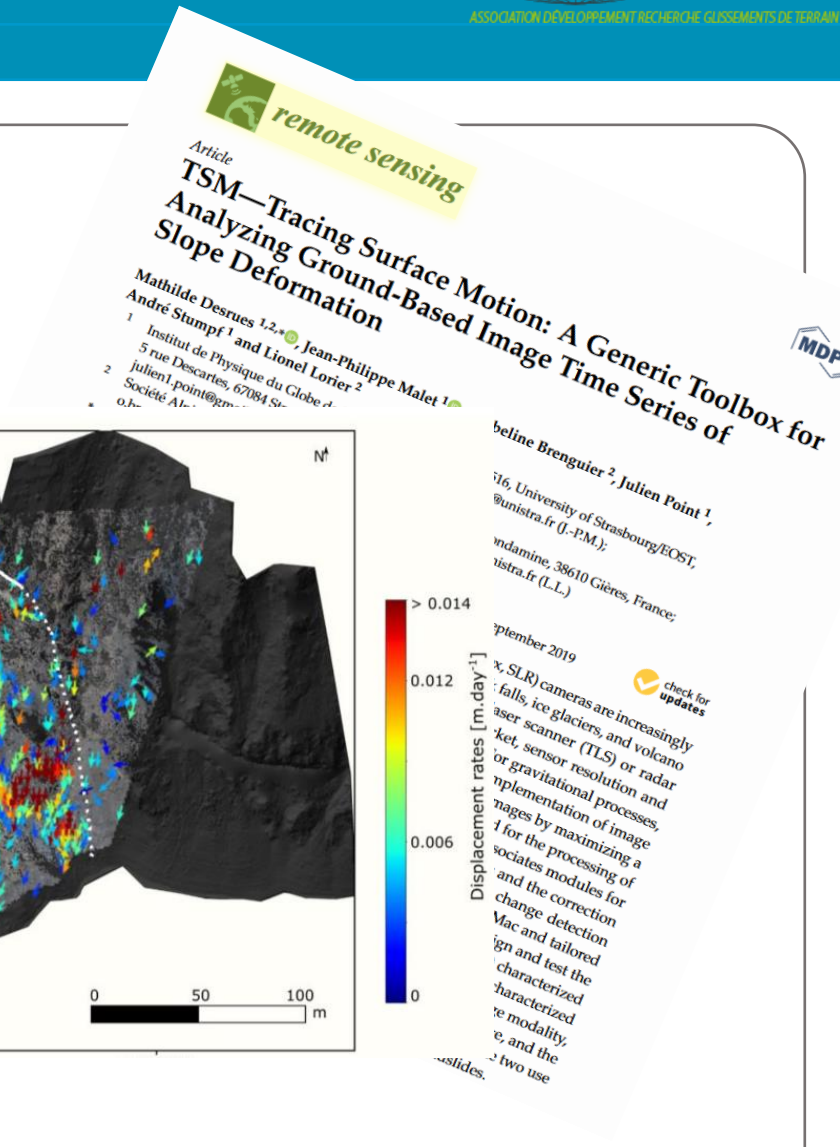
Abstract: Recent studies using satellite data have shown a growing interest in detecting and anticipating landslide failures. However, their value for an actual landslide prediction has shown variable results. Therefore, the use of satellite images for that purpose still requires additional attention. Here, we study the landslide of the Tunnel du Chambon in the French Alps that ruptured in July 2015, generating major impacts on economic activity and infrastructures. To evaluate the contribution of very high-resolution optical satellite images to characterize and potentially anticipate the landslide failure, we conduct here a retro analysis of its evolution. Two time periods are analyzed: September 2012 to September 2014, and May to July 2015. We combine Pléiades optical images analysis and geodetic measurements from in situ topographic monitoring. Satellite images were correlated to detect pre-failure motions, showing 1.4-m of displacement between September 2012 and September 2014. In situ geodetic measures were used to analyze motions during the main activity of the landslide in June and July 2015. Topographic measurements highlight different areas of deformations and two periods of strong activity, related to the [illegible] stage of the tertiary creep and to anthropic massive purges of unstable masses. The [illegible] toward the rupture observed in June and July 2015 over the topographic [illegible]llite observation between 2012 and 2014, showing that the [illegible] tertiary creep 2.5 years before its failure.

; Pléiades satellites; in-situ

M.Desrues et al. 2019

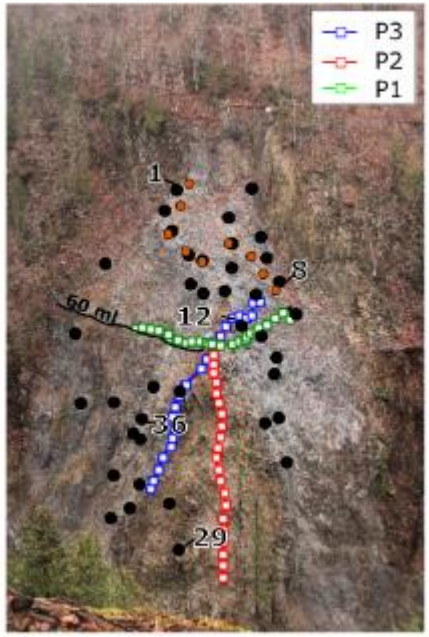
4. Operational monitoring of gravitational movements with image time series

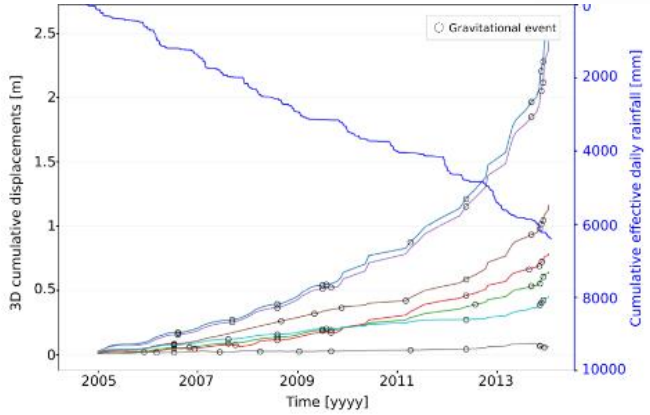


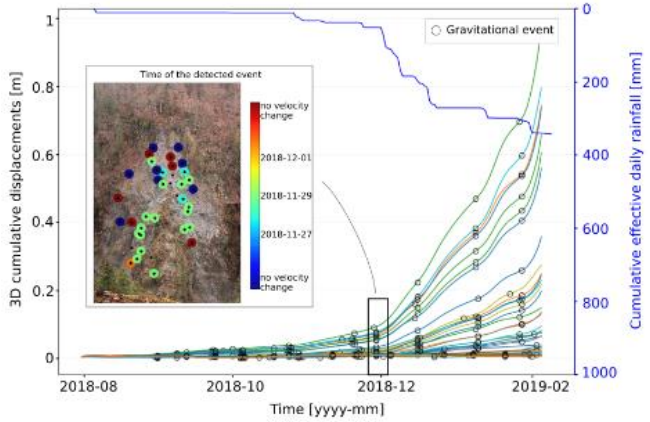


M.Desrues et al. 2019

4. Operational monitoring of gravitational movements with image time series







Landslide manuscript No.
(will be inserted by the editor)

Landslide kinematics inferred from in-situ measurements : the Cliets rock-slide (Savoie, French Alps)

Desrues M. · Malet J.-P. · Brenguier O. · Carrier A. · Mathy A. · Lorier L.

cepted: date

aper presents an analysis of two large rock toppling/sliding events n January 2014 and February 2019 at the Cliets unstable slope lps). To understand the mechanism involved and its control by ex- multi-technique analysis approach is used combining geological rological data analysis, topographic measurements and simple The pre-failure stage of the events is more particularly analyzed. s is found between triggering factors and surface motion though highlights the transition toppling-sliding. It showed that, at first ccurred 4 years before the first failure of 2014 while it hap- the second failure of 2019. From this date, the environment is sliding on an inclined plane. By applying a frictional model 4) we illustrated that the two events belong to an unstable ng regime. The time to failure (Voight, 1989) is forecasted ults are consistent with the observations. They confirm that redominant over the triggering factors for the two events.

Rock toppling · Topographic measurements · Time to Landslide frictional model

M.Desrues et al. 2021

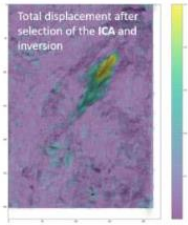
connect by cnes Space Tour 2021
Les applications spatiales : Tremplin pour l'Economie et la Société

OTELO

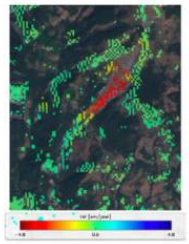
Outils de TELédétection opérationnelle des mOuvements de terrain

Un portfolio de produits complémentaires pour une vision synthétique du territoire

Lot 1 : Optique



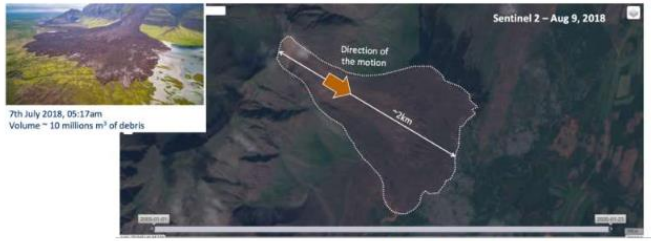
Lot 2 : InSAR



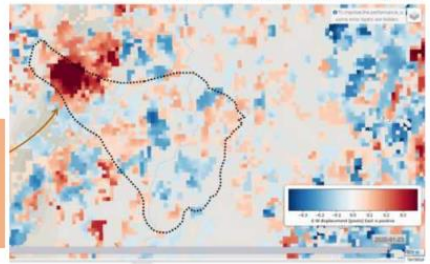
Lot 3 : Fusion

Fusion
Analyse des enjeux affectés (webservice)

Outil de consultation – visualisation en ligne



EW (left) and NS (right) displacement (pixel)



Déplacements détectés dans l'année précédent l'évènement

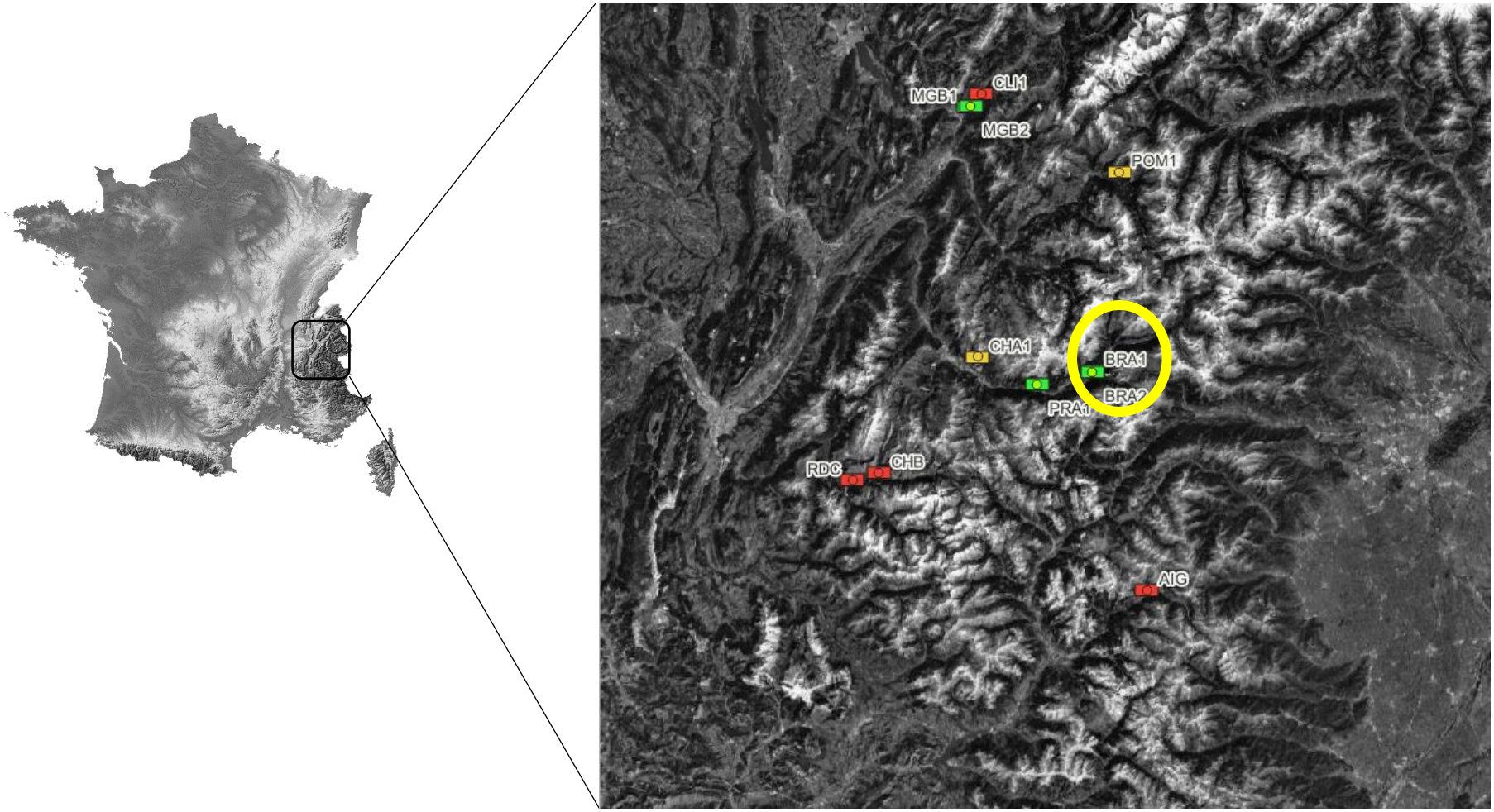
Cartes et séries temporelles multi-capteurs fusionnés
Visualiser les produits en ligne

Thèse CIFRE en cours : Bastien WIRTZ

ADRGT
ASSOCIATION DÉVELOPPEMENT RECHERCHE GLISSEMENTS DE TERRAIN

SAGE INGENIERIE

De la recherche appliquée vers l'opérationnel



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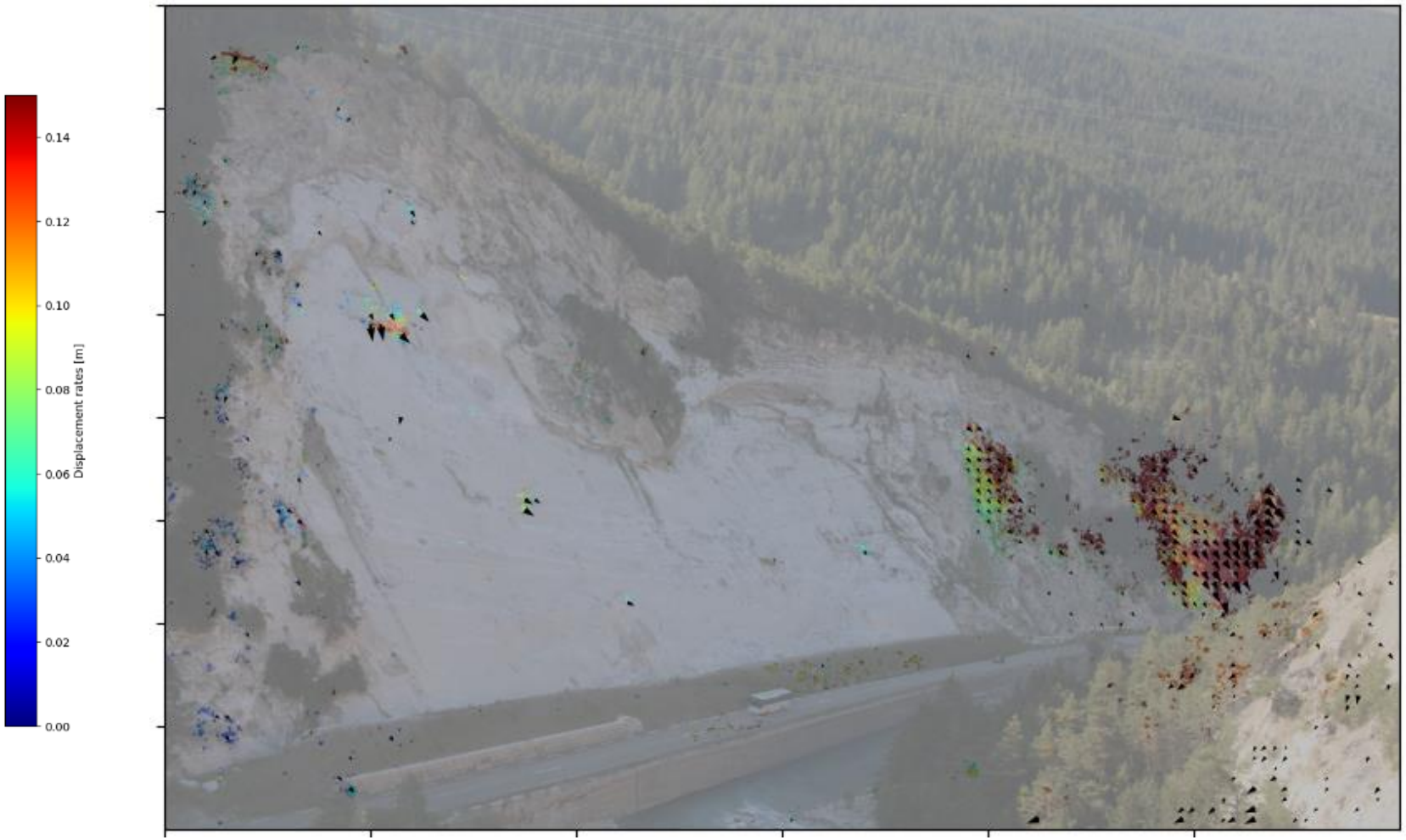
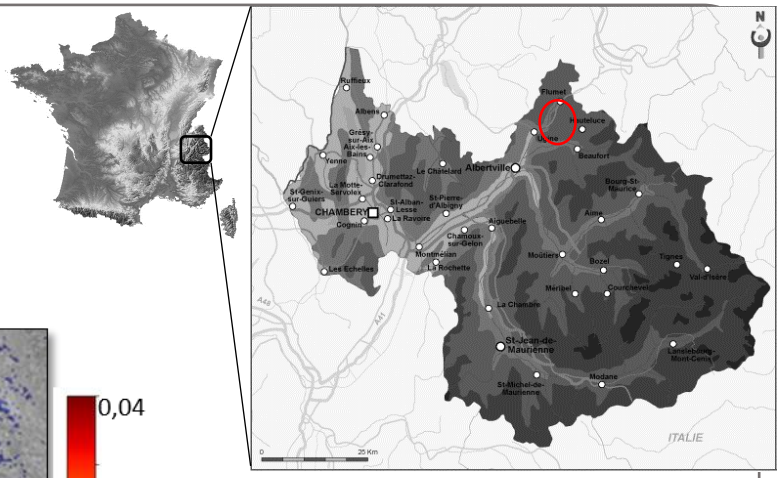
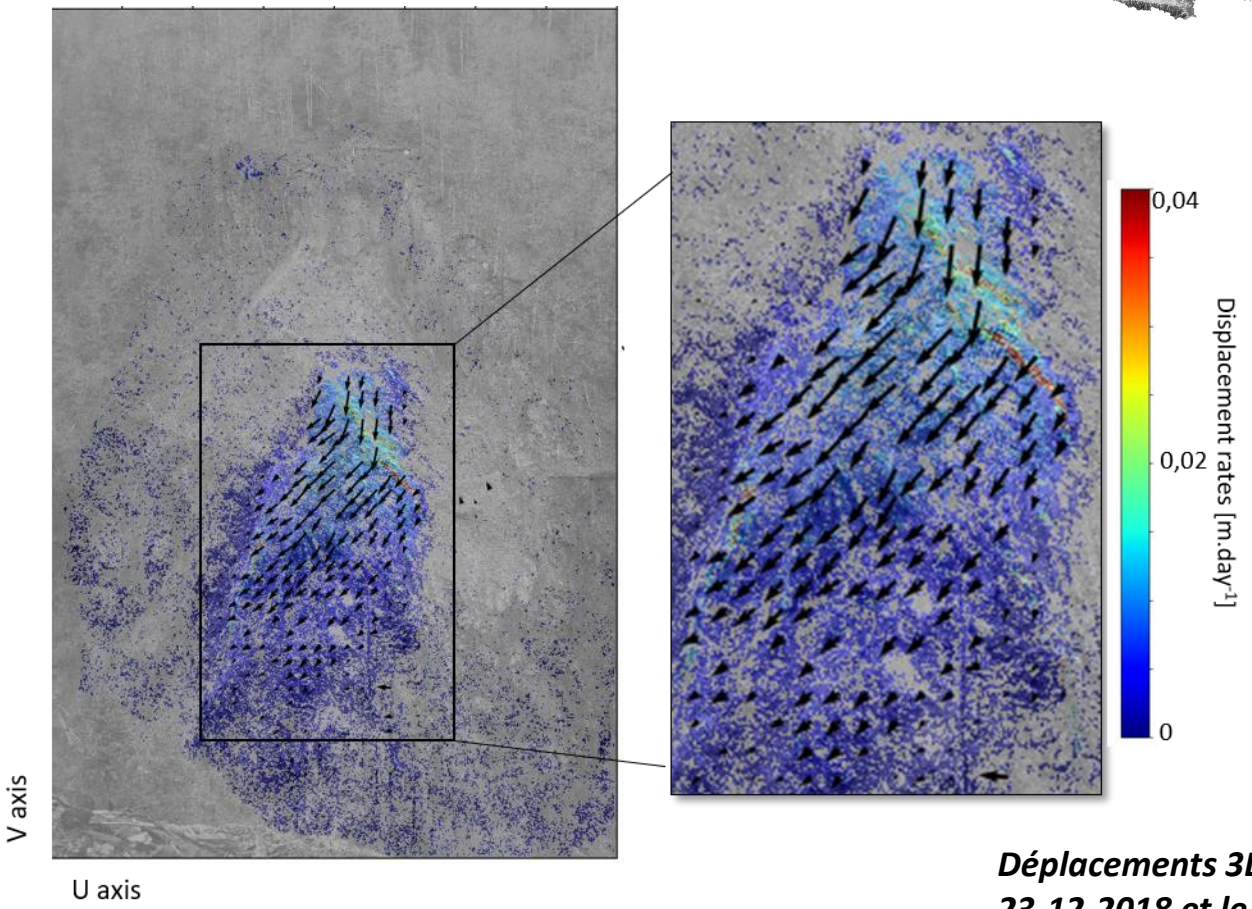


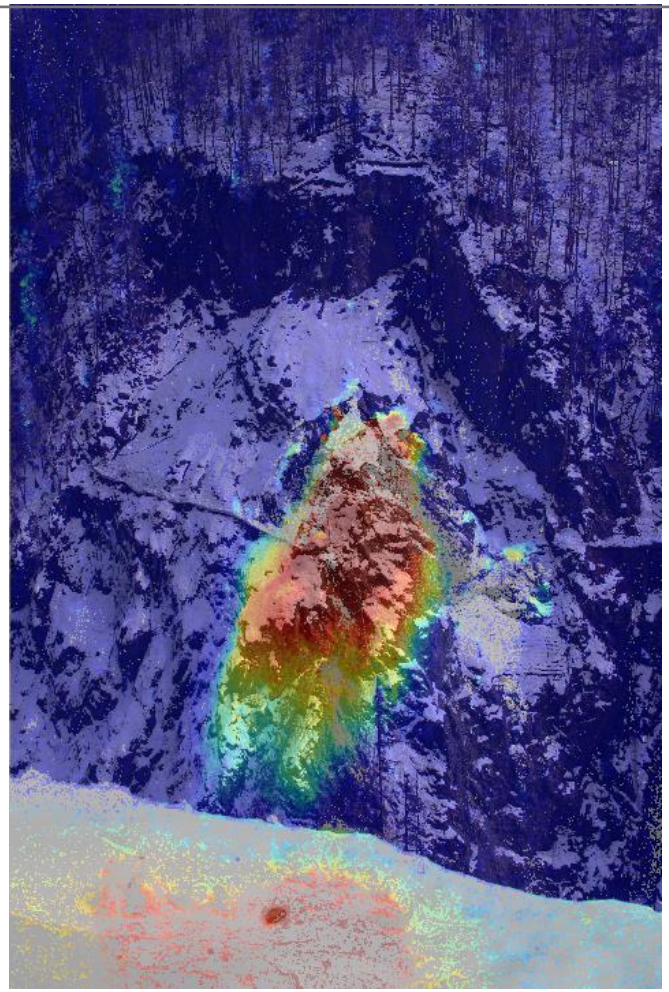
Suivi topo classique : 40 cibles





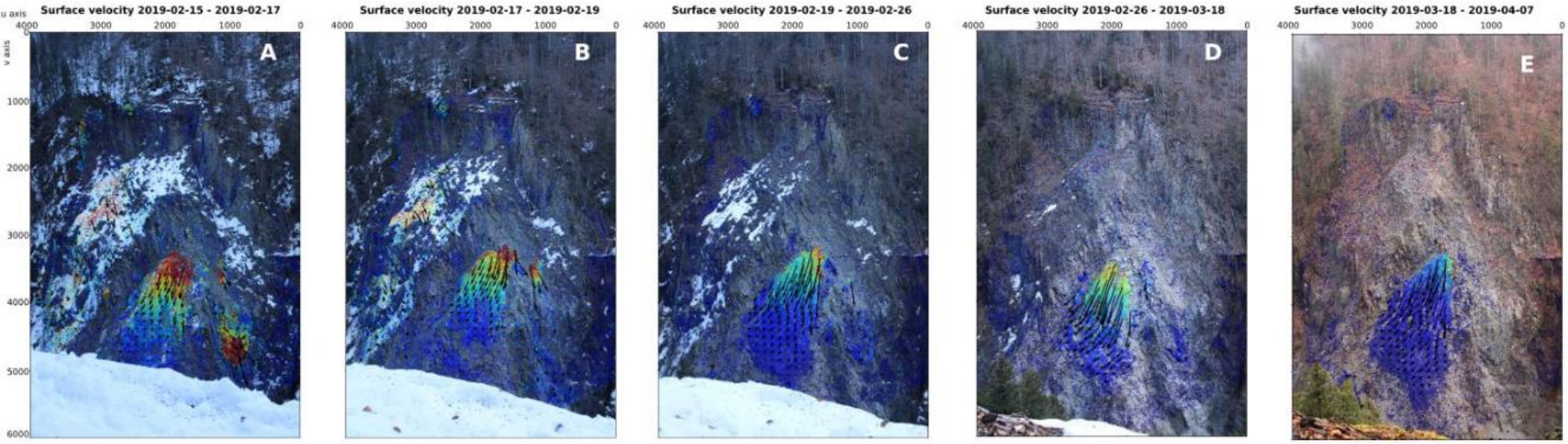
Déplacements 3D [m/jour] entre le 23-12-2018 et le 08-01-2019

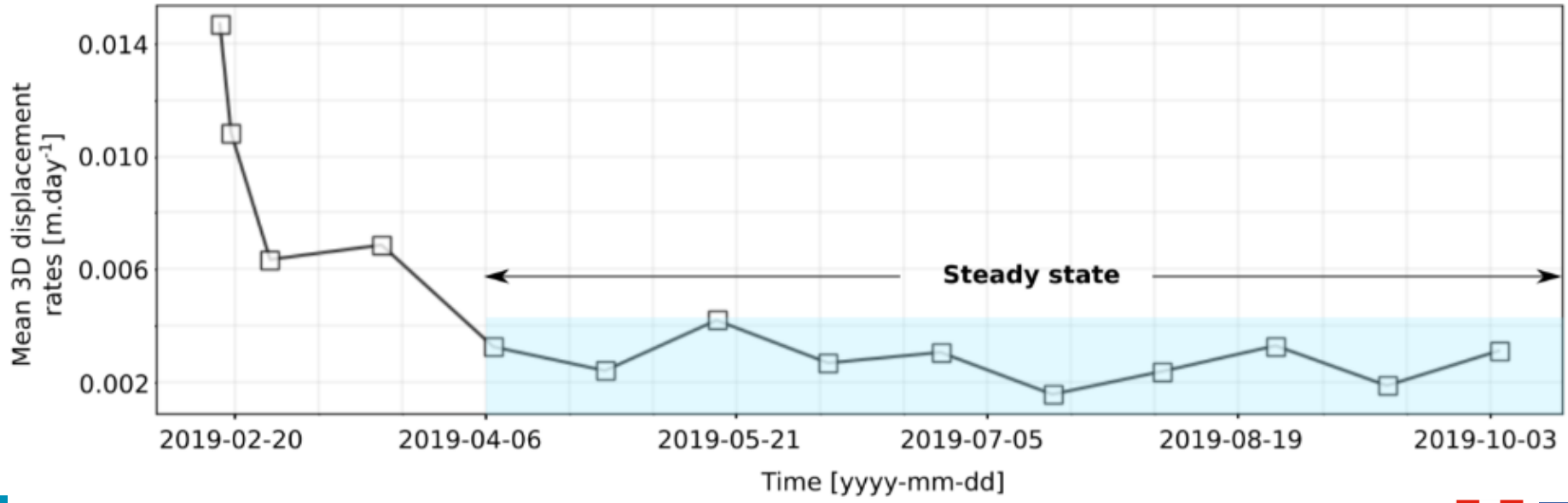
Le 9 février 2019



11-12h

6. Exemples d'application : Les Cliets – Val d'Arly (Savoie) : Suivi Post-rupture





Conclusion sur la méthode TSM

- Géométrie
- Dynamique
- Précurseurs
- Suivi post-rupture