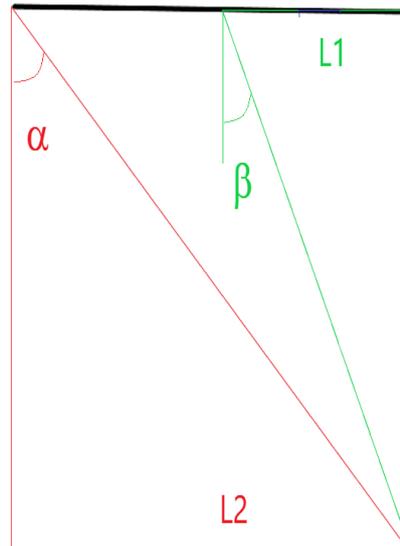


Text S1: geometry of a two-fault system using a seismic profile.



The Two-way travelttime (TWT) result of a seismic profile is often not adequate to measure the true dip angle of one single fault due to the variations of the velocity with depth. If the lateral velocity variations are small compared to the variations with depth, we can use the ratio of apparent dip angles of a two-fault system in order to calculate both true dip angles.

Alpha (α) and Beta (β) are the supposed constant deviation to the vertical of La Rouvière fault (LRF) and Bayne Rocherenard fault (BRF), respectively.

L1 (and L2) is the horizontal distance between the projection of the intersection point of both faults and the intersection of BRF (and LRF) with the ground surface.

There is a simple trigonometric relationship between these four parameters:

$$\frac{\tan \beta}{\tan \alpha} = \frac{L1}{L2} \quad (S1)$$

The equation to solve is therefore:

$$\frac{\tan x}{\tan \mu * x} = \lambda \quad (S2)$$

With :

- the unknown x that is the deviation to vertical of BRF
- mu (μ) the ratio between alpha and beta
- lambda (λ) the ratio between L1 and L2

We develop a python program using the Newton algorithm to resolve this equation for a couple of values (μ, λ) given by the seismic M201 profile (see Figure 4).

If $\mu = 4$, there is an explicit solution:

$$(\tan x)^2 = 3 - 2\lambda - 2\sqrt{1 + (\lambda - 1)^2} \quad (S3)$$

If μ value is less than 4, the Newton method is applied using a first estimate corresponding to the explicit solution obtained with $\mu = 4$ (see text S2).

Text S2: python script to resolve the equation (S2)

```
#!/usr/bin/env python3

"""
:author: André Burnol
:date: 08 avril 2021
"""

from math import tan, atan, cos, sqrt, pi

def beta4rad(l):
    """fonction inverse de  $l = \tan(x)/\tan(4x)$ 

    x=0 if l=1/4
    """
    return atan(sqrt(3 - 2 * l - 2 * sqrt(l**2 - 2 * l + 2)))

def beta4(l):
    """fonction inverse de  $l = \tan(x)/\tan(4x)$ 

    x=0 if l=1/4
    """
    return 180 * beta4rad(l) / pi

def betarad_from_mu_lambda(mu, l):
    """fonction inverse de  $l = \tan(x)/\tan(\mu * x)$ 

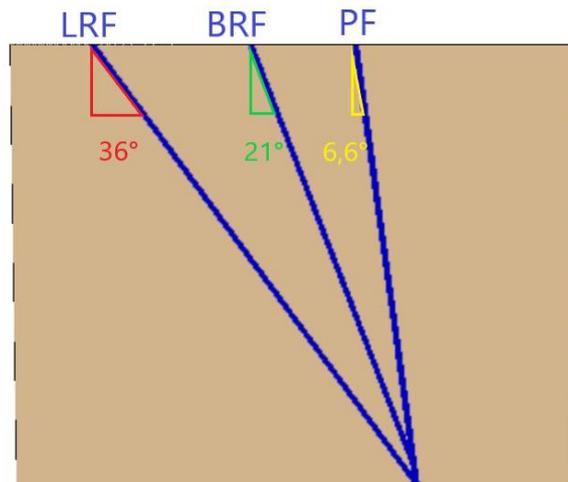
    x=0 if l=1/mu
    """
    x0 = 4/mu * beta4rad(mu * l/4)
    x = x0
    epsilon = 1e-14 # objectif en erreur relative
    delta = - (tan(x)-l*tan(mu*x))/(1/cos(x)**2-mu*l/cos(mu*x)**2)
    while abs(delta) > epsilon * abs(x):
        x = x + delta
        # méthode de Newton pour résoudre  $\tan(x) - l * \tan(\mu*x) = 0$ 
        delta = - (tan(x)-l*tan(mu*x))/(1/cos(x)**2- mu*l/cos(mu*x)**2)
    return x

def beta_from_mu_lambda(mu, l):
    """fonction inverse de  $l = \tan(x)/\tan(\mu*x)$ 

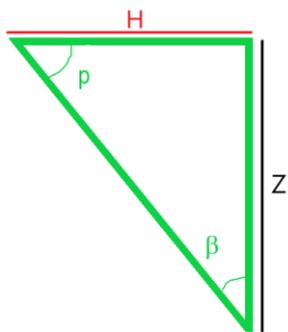
    if lambda=l=0.5128 and mu=1.76
    >>> beta_from_mu_lambda(1.76, 0.5128)
    20.55150781493907
    >>> beta_from_mu_lambda(1.76, 0.5128)*1.76
    36.170653754292765
    >>> beta_from_mu_lambda(1.76, 0.5128)/3.1
    6.629518649980345
    """
    return 180 * betarad_from_mu_lambda(mu, l) / pi
```

Text S3: application of the python script to the three-fault system using M201 seismic profile

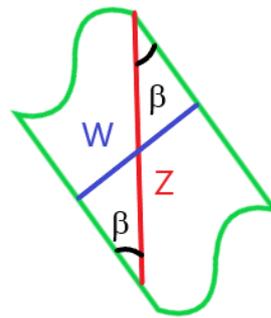
From the M201 seismic profile (see Figure 4), we found $(\mu, \lambda) = (1.76, 0.5128)$ and the solution given by the $\beta_from_mu_lambda(\mu, \lambda)$ is $\beta = 21^\circ$ and therefore $\alpha = \mu * \beta = 36^\circ$. The same method is used for the Paurière fault (PF), we found using M201 profile a ratio of both angles of $\mu_2 = 3.1$ and therefore the deviation of PF to the vertical is $\beta / 3.1 = 6.6^\circ$.



The corresponding dip angles of LRF, BRF and PF are therefore 54° , 69° and 83.4° (Figure 4c). Another way to calculate the deviation to the vertical of BRF is to use the observations of SC03 geotechnical drilling conducted in 2016 by the quarry owner (see Figure S5 below):



$$\tan \beta = \frac{H}{Z} \quad (S4)$$



$$Z \times \sin \beta = W \quad (S5)$$

In Figure S5, the photo in S5b of SC03 core reveals a natural sub-vertical fracture at 90.5m vertical depth (with calcite veins). By using $(H,Z) = (35.6 \text{ m}, 90,5 \text{ m})$, we found $\beta = 21.47^\circ$ using (4). Both values of the dip angle of BRF we found are therefore consistent and credible if it assumed that this dip angle is laterally and vertically constant.

Using this β value, we can estimate the thickness of BRF noted W by supposing that the height Z of (5) is located between a depth of approximately 83 m to 115 m (see Figure S5): $W = 32 \text{ m} * \sin(21.47^\circ) = 11.7 \text{ m}$. Therefore, a range of values of the width between 10 m and 20 m can be used (20 m is the chosen width value in Table 1 and Table A1).

Supplementary tables

Table S1: Characteristics of the produced interferograms.

Track ID	Acquisition dates	Perpendicular baseline (m)	Time span (days)
059 (ascending)	6/11/2019 and 12/11/2019	13	6
161 (ascending)	7/11/2019 and 13/11/2019	92	6
037 (descending)	11/11/2019 and 17/11/2019	7	6
139 (descending)	6/11/2019 and 12/11/2019	51	6

Supplementary Figures

Figure S1: example of use of the Cosiscorr's profiles stacking tool. Left: A059 interferogram represented in Cosiscorr with fault "candidate" for LRF in red line and the yellow area containing the 10 profiles to be stacked (1500m X 150m). Right: stacked profile across LRF (position in pixels - i.e. 15m - displacement values in meters). Displacement on the fault is automatically computed as the difference at 0 position between the 2 green lines (linearly fitting the motion each side of the fault).

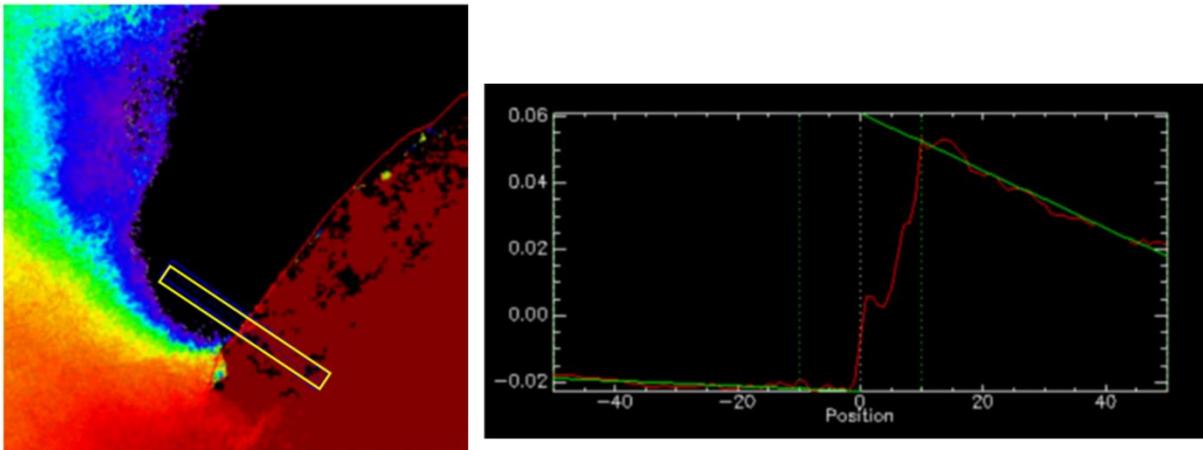


Figure S2: Example of stacked profiles (left – plain line shows the stacked profile, dashed line the dispersion, values in m, x-axis in pixel, 1 pixel = 15m) and their position (rectangles containing the profiles to be stacked identified by profiles numbers) on the interferogram (right). Positions of LRF and BRF are shown: discontinuities on the profiles are consistent with the proposed faults positions. Coordinates UTM 31 N in meters. The palette has been chosen saturated outside the interval [-1.2, 0.9] cm is Line of Sight in order to visually enhance the borders of the moving area. In particular in South-West and North-East ends of the observed ruptures, the resulting pattern is consistent with the faults locations.

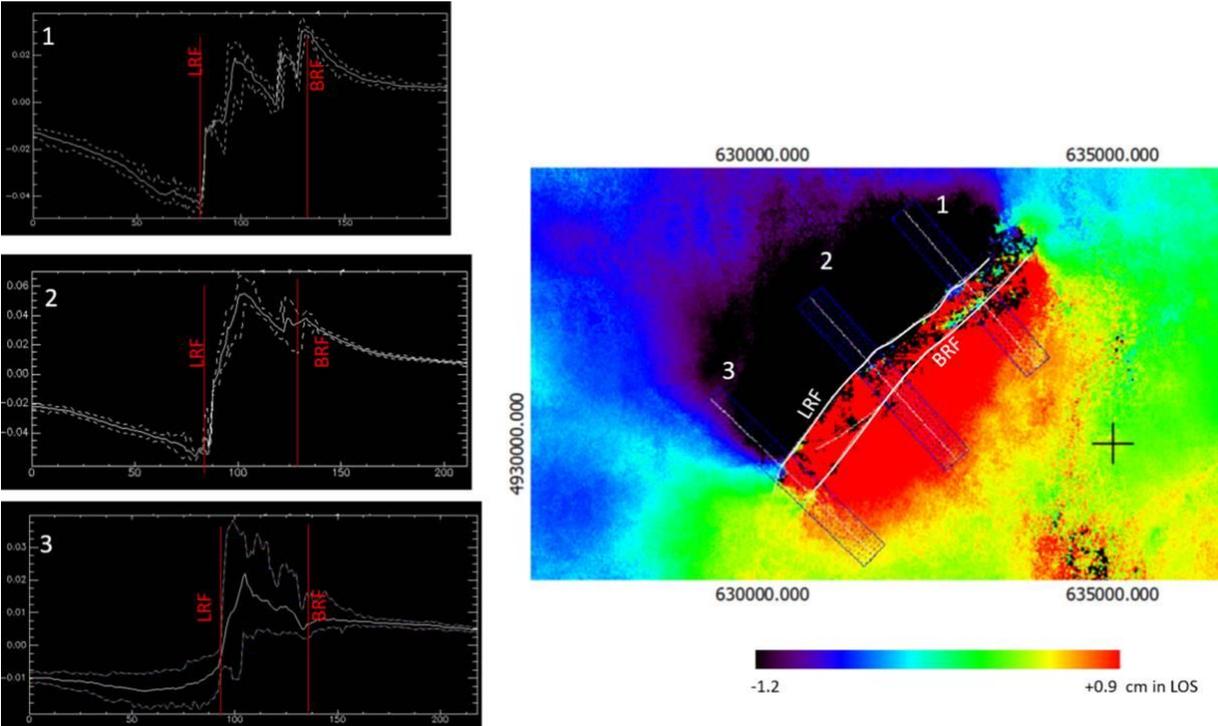


Figure S3: stacked profiles estimated on P1 and LFR12 points (left) and their locations on the optical image of the site showing the position of the faults (right). Plain lines shows the stacked profiles, dashed lines the dispersions, values in m, x-axis in pixel, 1 pixel = 15m.

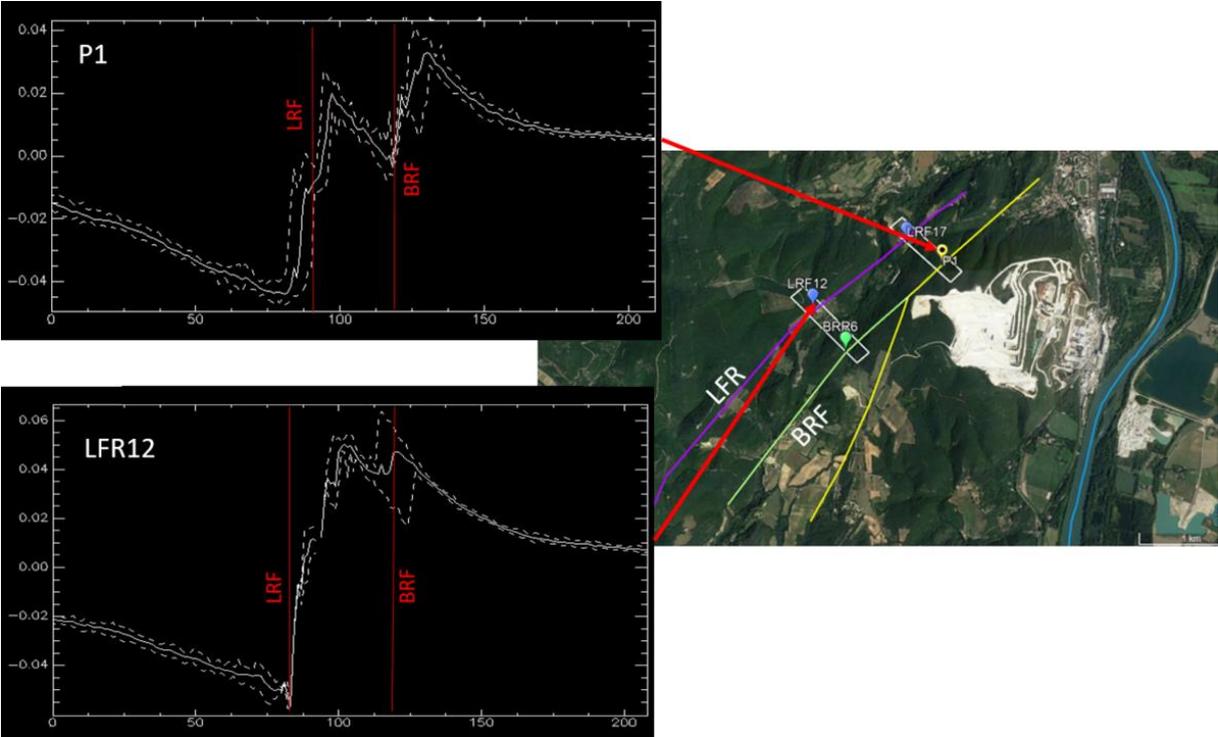


Figure S4: diagram illustrating a specific unwrapping issue due to two parallel jumps. Assume that in a very simplified way: 1) two surface ruptures represented by F1 and F2); 2) the distance between ruptures is small respect to their lengths (if not an unwrapping algorithm could favor other solutions avoiding crossing the jumps and therefore minimizing the effect described below). Red line is a profile on the original wrapped interferogram. Assuming that the displacement should be zero at $\pm \infty$, left part of F1 and right part of F2 can be unambiguously unwrapped (blue dashed line). However between F1 and F2, the unwrapping solution results ambiguous: on solution a) all the displacement is on F2, on solution b) all the displacement is on F1, intermediary solutions are possible (e.g. c).

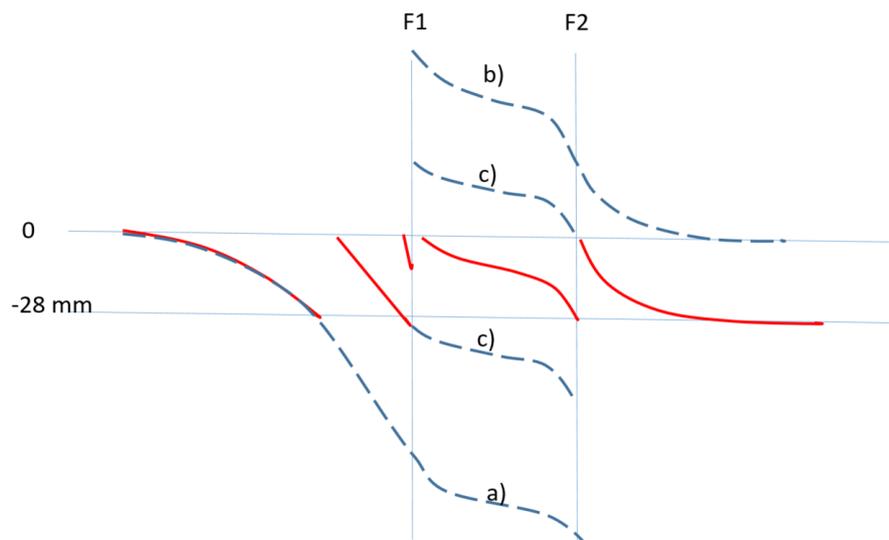
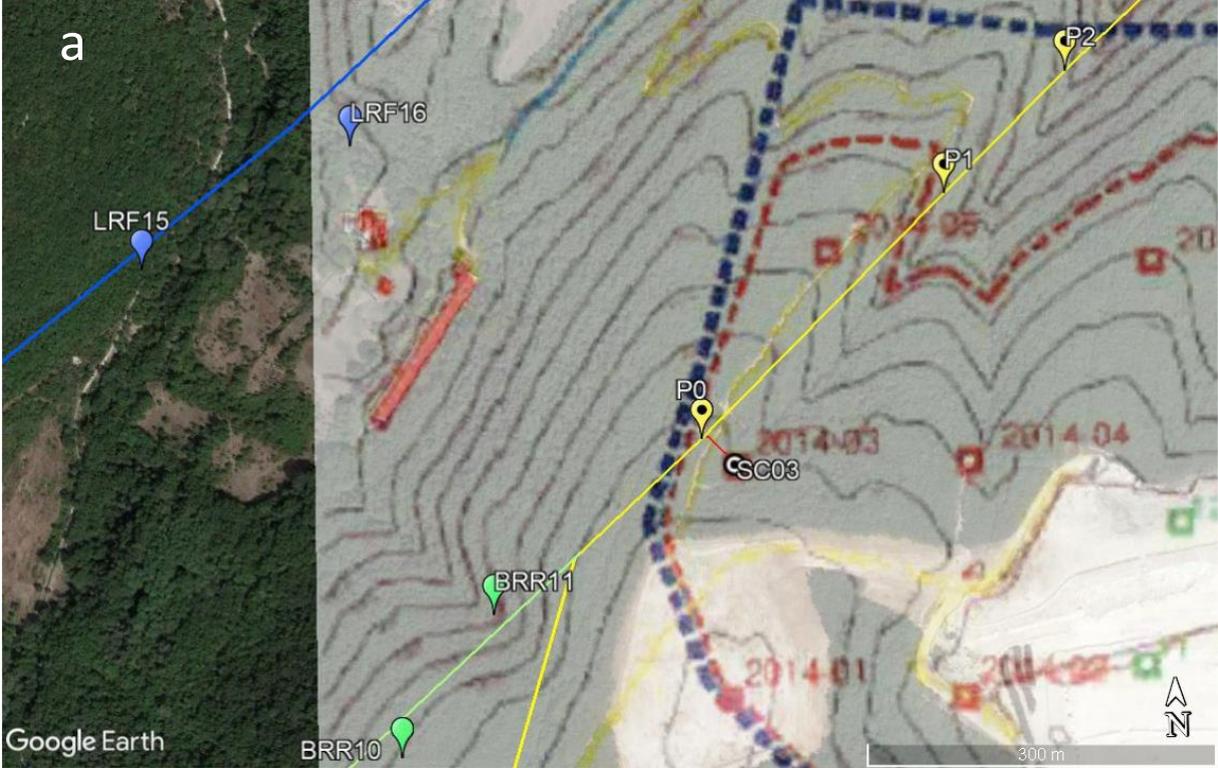


Figure S5: geotechnical drilling SC03 conducted in 2016 by the quarry owner. a) location of SC03 about 35.6 m (red line) southeast of Bayne Rocherenard fault (yellow line near P0); b) core samples at depth between 89 m and 92 m; c) core samples at depth between 112.5 m and 115.3 m.



Caisse n° 31 : Photo 15



Caisse n° 39 : Photo 23

Figure S6: surface soil moisture (SSM) acquired by SMOS (SMOS-CATDS) in the L2 cell during 2015-2019. a) every 3 days (ascending track); b) 10 days (descending track) compared to Soil Moisture (SM) at 30 cm (Berzème) using effective saturation S_e .

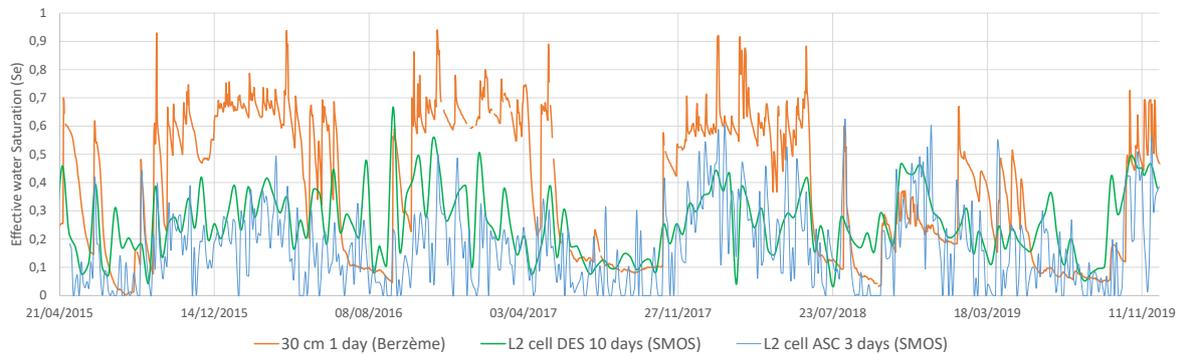


Figure S7: ground motion recorded at Clauzel house (CLAU) (location in Figure 9) for the blast event of the 25th September 2019. Filtered (1-10 Hz) and integrated seismograms in the left panel. The horizontal particle motion at the right panel. The first 0.3 second is highlighted as green on the left panel and as orange line on the right panel. The azimuth is estimated to $N98^\circ E \pm 20^\circ$ (green line with broken lines) with respect to the true value of $N111^\circ E$ (Ev1 in Figure 9).

