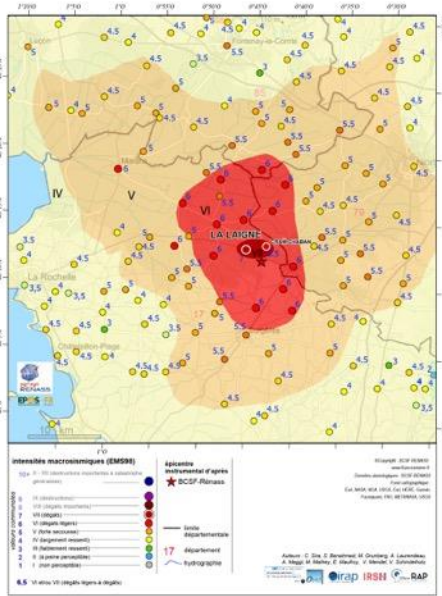


# Collecting and analysing seismic effects on buildings using internet forms in the context of French insurance and global warning



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Photographie GIM 2023 (La Laigne)



To estimate the intensities, we need to qualify and quantify the seismic effects on :

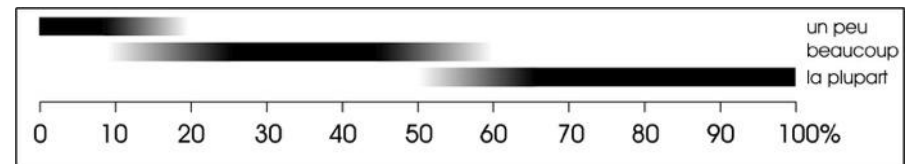
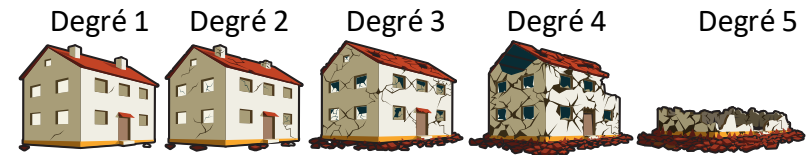
- people
- objects
- furniture
- **buildings**
- environment

**BUT : We found new difficulties in France due to the global warning effects and insurance context in using this indicators**



we need to know :

- vulnerability classes
- The severity of the effects
- The quantities of effects produced



# La Laigne earthquake 16/06/2023 (5.3 ML, Int max VII)

## Macroseismic data collection for estimating intensities

**Town halls collective questionnaires**

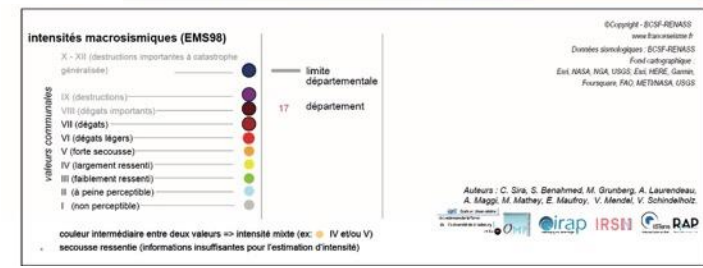
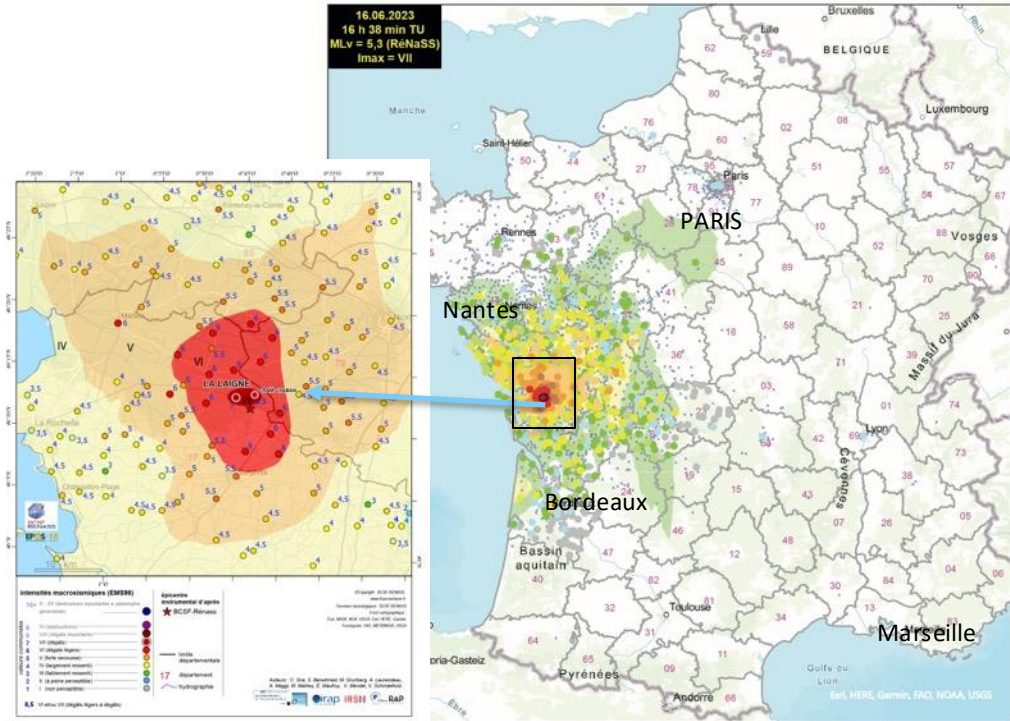
- basis of estimate : 800 municipalities

**Individual questionnaires**  
 6145 quest./2877 municipalities

- **Damage building  $\geq$  degree 3 EMS-98**

=> **Field survey (20-28/06/2023)**

- 9 investigators /1 week
- 20 municipalities studied
- 425 building expertises  
 vulnerability classe +  
 degree of damage)



## To realise his macroseismic estimation, the investigator should ask himself the following questions:

- Are the effects on the indicators representative of the tremor (saturation of indicators)?
- Do the classes of objects observed represent all the classes of vulnerability?
- Are the observable effects on the indicators disrupted by particular conditions :
  - situation (accessibility, visibility),
  - prior effects
  - declarative bias (absence or exaggeration)?

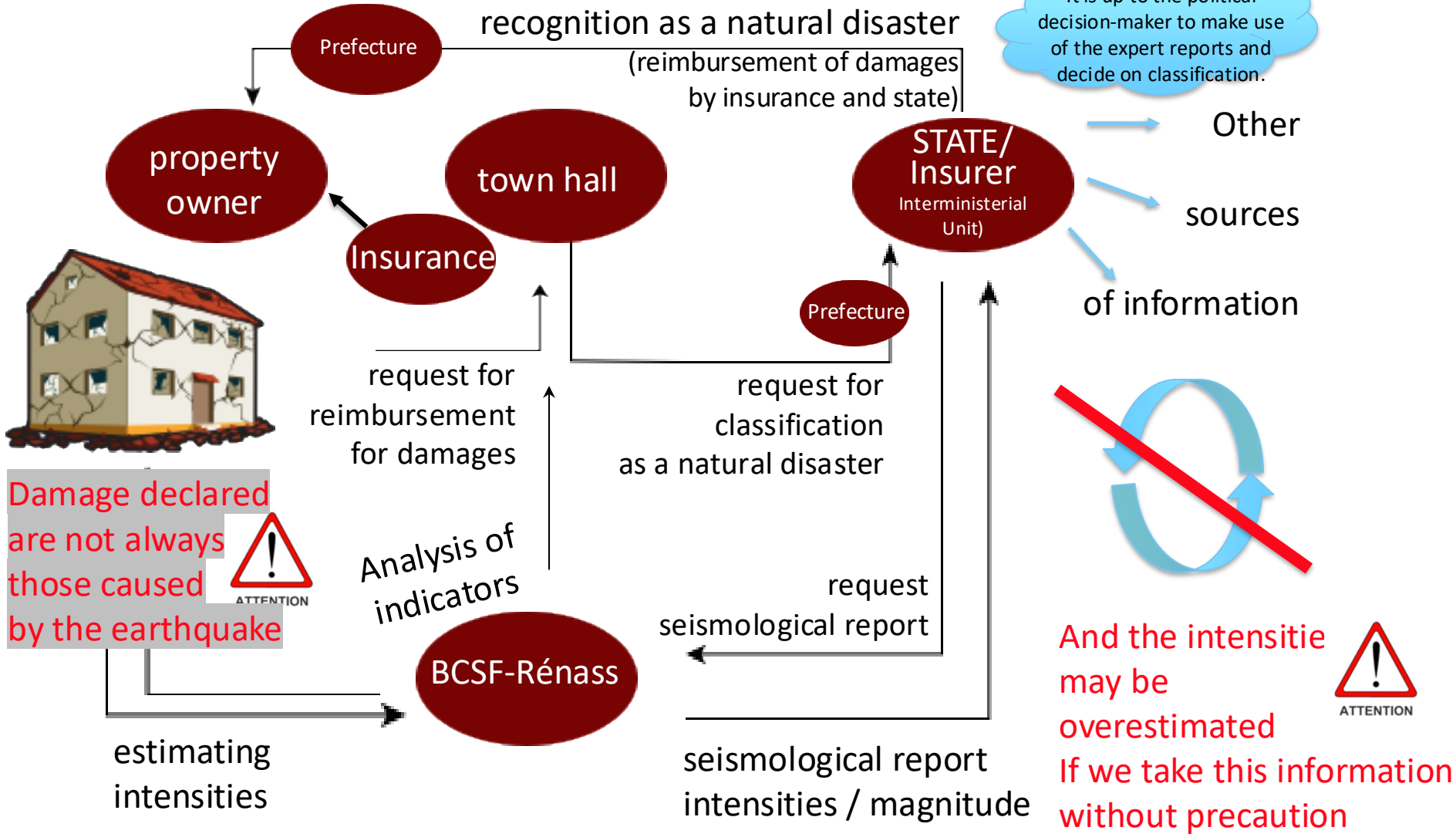
**With regard to the construction indicator, in recent years we have seen an exaggeration of damage claims.**

**What are the causes of this?**

- The search for reimbursement?
- Lack of observation prior to the earthquake?
- Global warming effect?



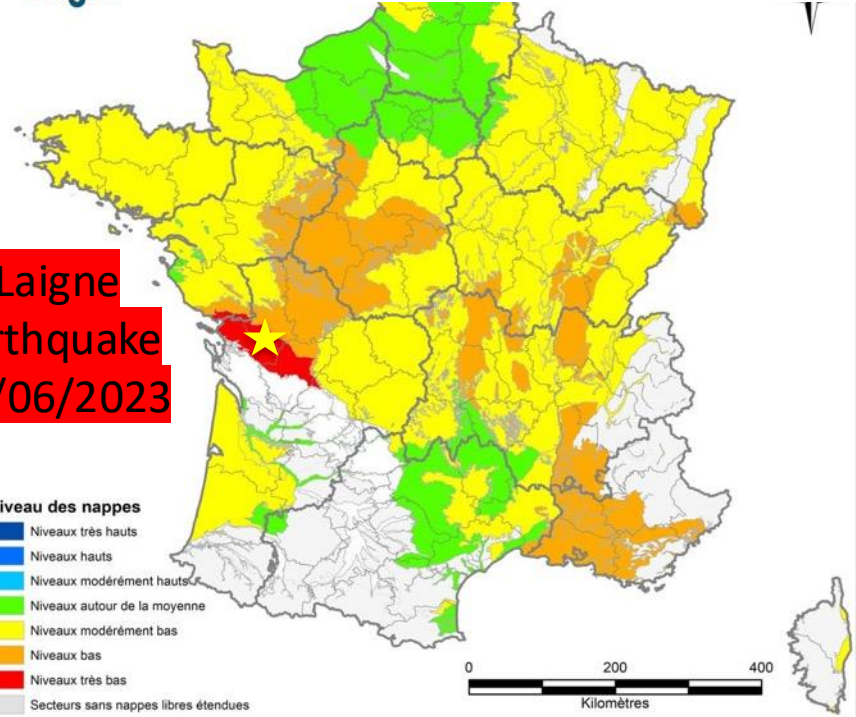
# Insurance procedure in France



One year before the La Laigne earthquake, the region was hit by a climatic disaster in 2022: severe drought (the second hottest summer since 1900 according to météo France).

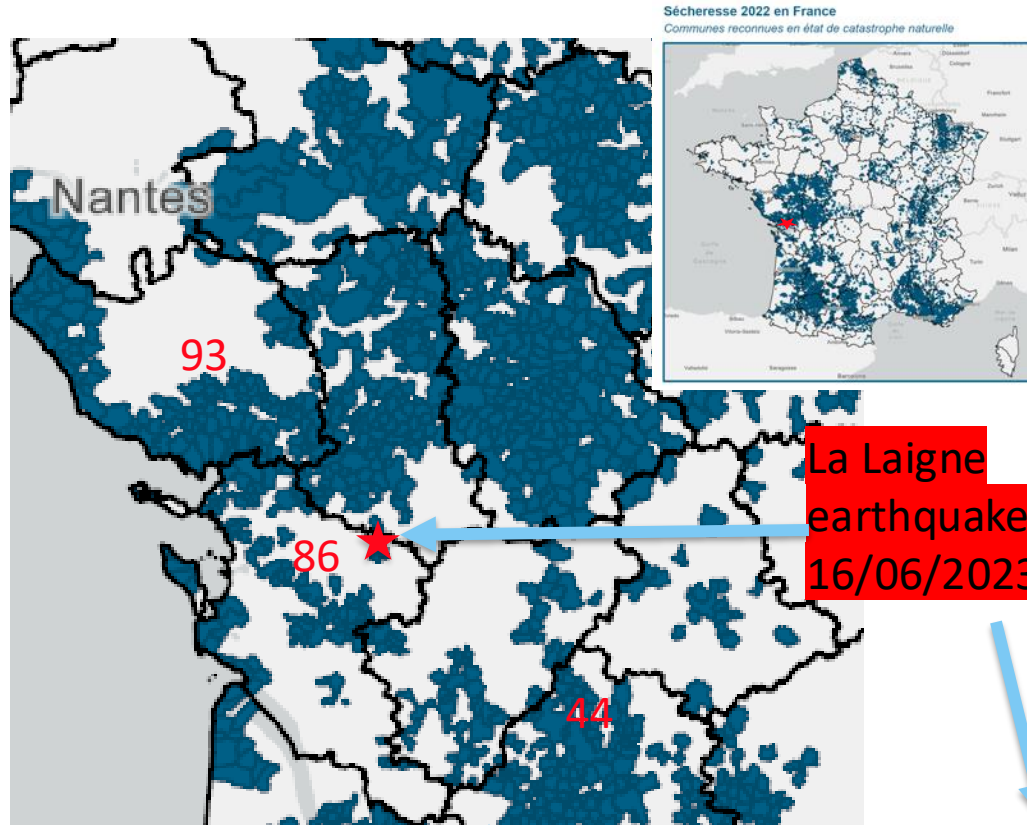
## DAMAGE OBSERVED

Cracks in buildings caused by the natural phenomenon of differential ground movement due to drought and the rehydration of clay soils (shrink-swell)



Groundwater levels June 2022





221 municipalities in the Charente-Maritime department requested recognition for cracks linked mainly to the phenomenon of clay shrinkage and swelling. (daily Sud-Ouest)  
 39% were recognised as ‘natural disasters’ in Charente-Maritime (blue zones on the map)

Many owners have not been reimbursed by the state for the damage they have reported (perhaps with good reason ?).

Geographically and temporally, this earthquake occurred at a time when many municipalities were not recognised for ‘drought’ damage (white zone).

<https://catastrophes-naturelles.ccr.fr>

time



2022

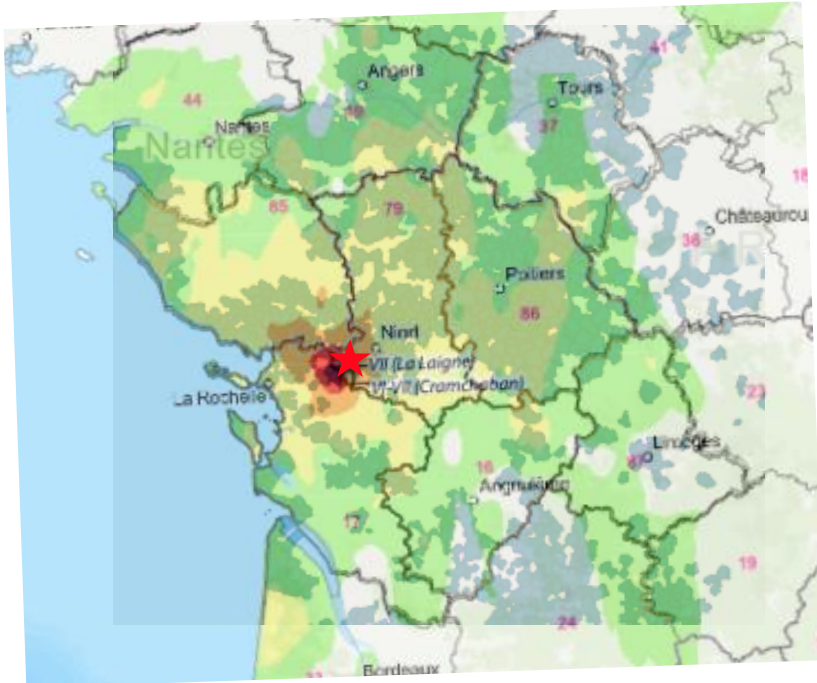
shrink-swell (clay soil)



2023

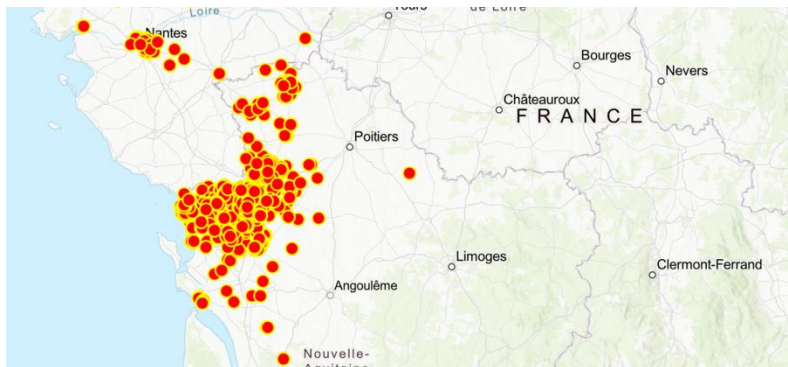
earthquake

La Laigne  
 earthquake  
 16/06/2023



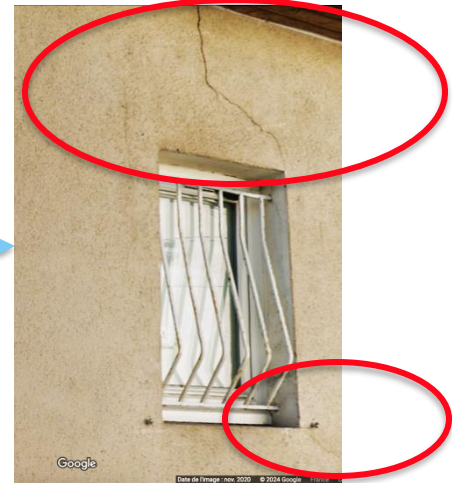
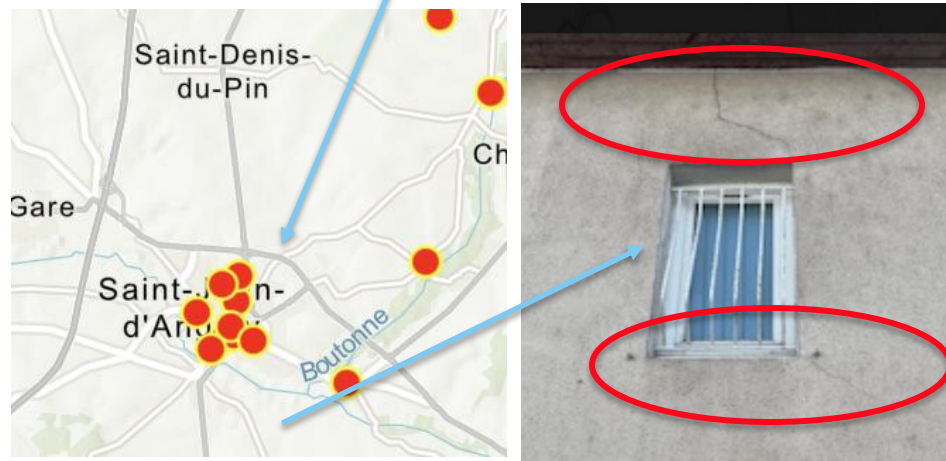
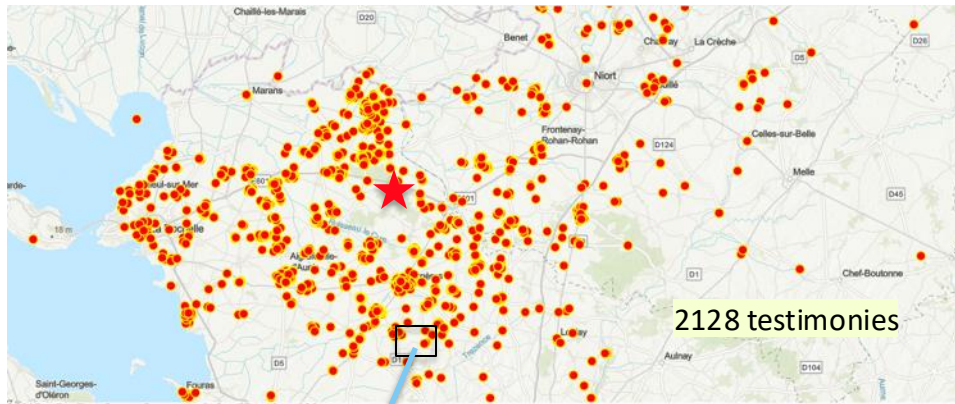
Carte finale d'intensités

- 1 year later after the climatic disaster, for many property owners, the earthquake is an opportunity to obtain recognition of damage seismic or not seismic (reimbursement)
- Declarations of 'seismic' cracks cover a very large area (sometimes up to 150 km from the epicentre), even if the depth of the hypocenter was superficial (3 km).
- In the majority of municipalities, this damage to buildings is not consistent with the rather weak to moderate effects declared on other indicators (people, objects, furniture).
- Many unclassified municipalities are claiming damage and recognition from the State. Supported by repair estimates, all types of damage are sometimes reported.
- **How can the BCSF-Rénass check the validity of the damage information on buildings and avoid overestimating intensities?**





# Creation of a new supplementary individual internet form specifically for damage (more precise than the general form)



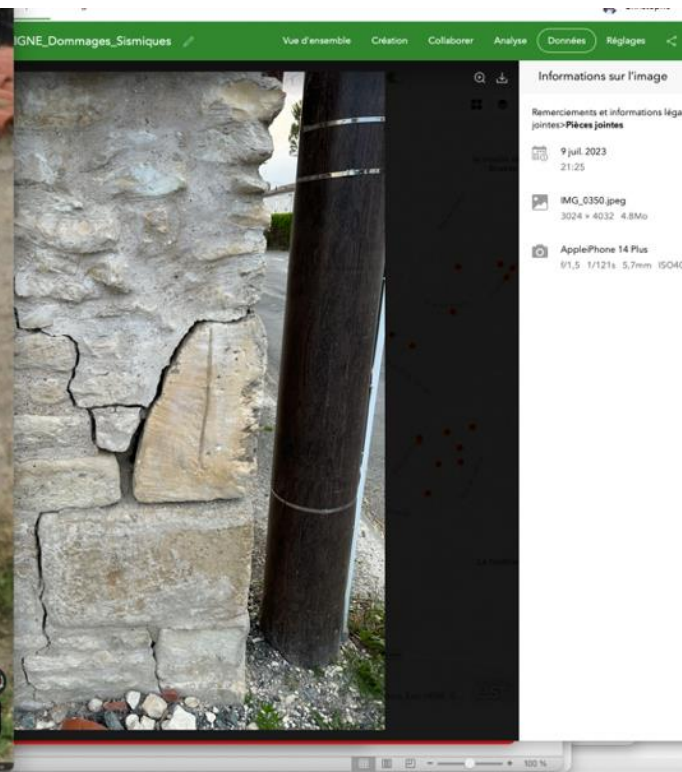
- Type of building (indiv, collective)
- Date of construction
- Type of structure (drop-down menu by type)
- Floor structure (wood, concrete)
- Degree of damage (drop-down menu)
- Description of damage
- photos
- Location.

*Beyond 5 km from the epicentre, almost 80% of the buildings visible in photographs before the damage occurred showed damage identical to that declared by the owner as seismic damage.*

GooglestreetView2020

Prior damage

# A comparison of the damage photographed with images of the building prior to the earthquake is essential



GoogleStreetView january 2023

Declaration june 2023

(18 km from the epicentre)

Prior damage

GoogleStreetView 2022

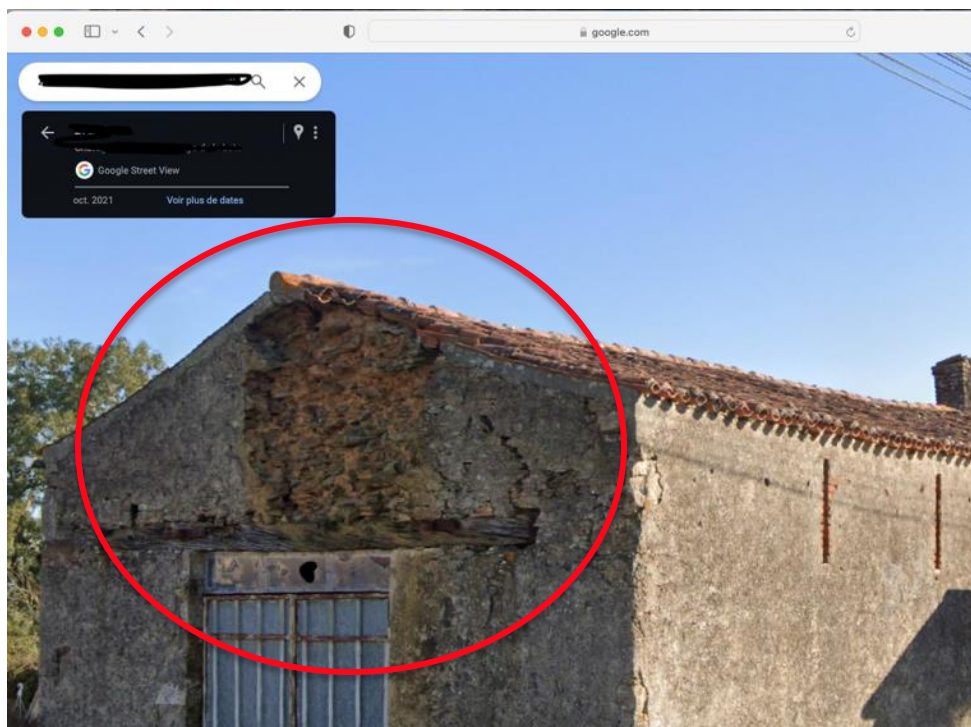


Declaration june 2023



Prior damage

## GoogleStreetView 2021



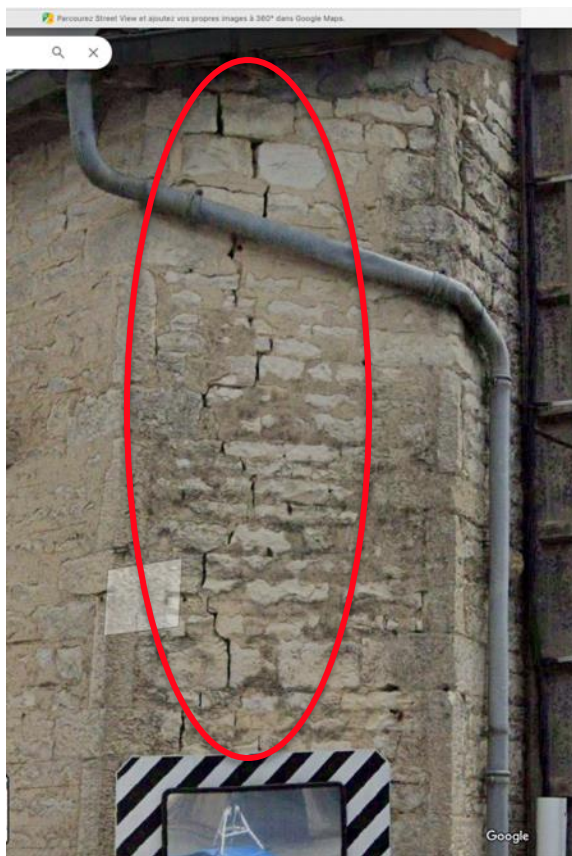
## Declaration 2023

Dossier [redacted]  
 [redacted] es l'ard de vous  
 Informer des dégâts je vous fais parvenir des photos comme reception [redacted]

A screenshot of a 2023 declaration form. The form contains a photograph of the same building as in the 2021 Google Street View image, with the damaged roof area circled in red. The form is partially redacted with black boxes.

Prior damage

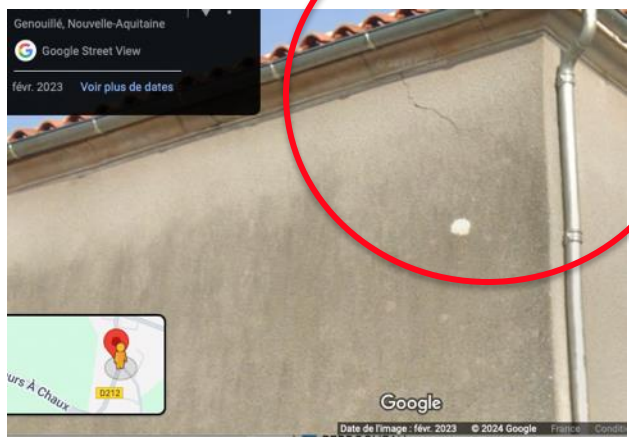
## GoogleStreetView 2021



## Déclaration 2023



Prior damage



GoogleStreetView february 2023

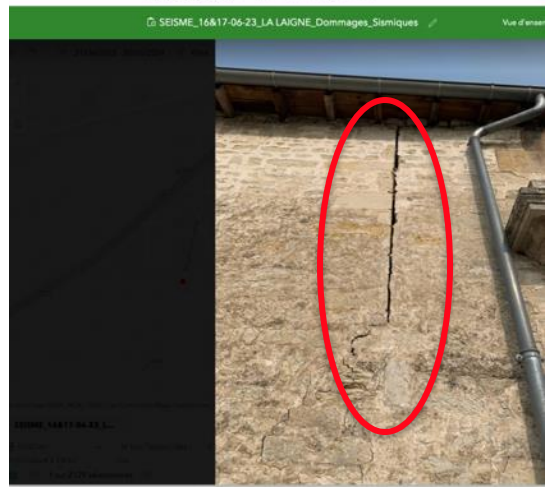


Declaration june 2023

(20 km from the epicenter)



GoogleStreetView 2022



Declaration june 2023

(16 km from the epicenter)

Prior damage

## Visual analysis of non-seismic damage (ageing plaster, old cracks, etc.)



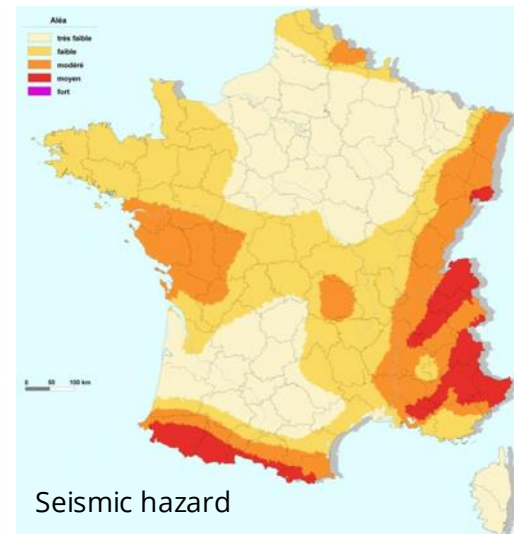
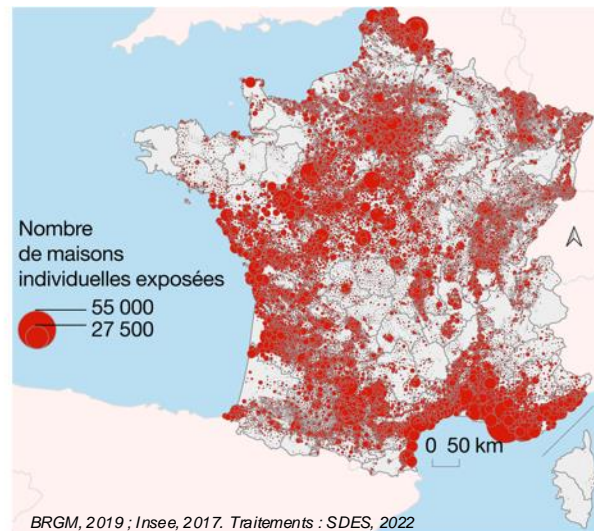
Prior damage

# Conclusion

- Global warming is not directly responsible for an increase in the number of earthquakes, but it does increase the vulnerability and damage of buildings to seismic effects in advance, and may contribute to an increase in the intensity values if the investigators do not verify the damage declared on questionnaires.
- The french insurance context for reimbursing damage is also a factor encouraging property owners to declare non-seismic damages.

48% of soil exposed to shrink-swell

10.4 million single-family homes exposed to clay shrinkage and swelling (strong or medium)





## Conclusion

### In this context of increasing prior damage, it's important to :

- Increase the number of sources of information (cross-checking/cross-referencing/comparison analysis)
- Analyse and compare all indicators (adequacy)
- Carry out missions to ensure the severity of the tremor, both in the epicentral zone and at distant points (to increase certainty)
- To be familiar with the background to the area under study, its 'disaster history' and the state of its buildings .
- To be aware of the insurance particularities of the country, which may have an impact on the building indicator studied.



cracked house in the commune of Cour-Cheverny not recognised as a cat-nat drought since 2018 (CEREMA)

# Thank you for your attention

Contact : [sira@unistra.fr](mailto:sira@unistra.fr)

## Ref.:

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- **Sites internet**
- **Ministère de la Transition écologique et de la cohésion des territoires**
- <https://www.statistiques.developpement-durable.gouv.fr/edition-numerique/chiffres-cles-risques-naturels-2023/25-seismes-en-metropole-et-en>
- **Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement (CEREMA)**
- <https://www.cerema.fr/fr/actualites/phenomene-retrait-gonflement-sols-argileux-rga-definitions>
- **Caisse centrale de réassurance :**
- <https://catastrophes-naturelles.ccr.fr>



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<https://renass.unistra.fr>

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