

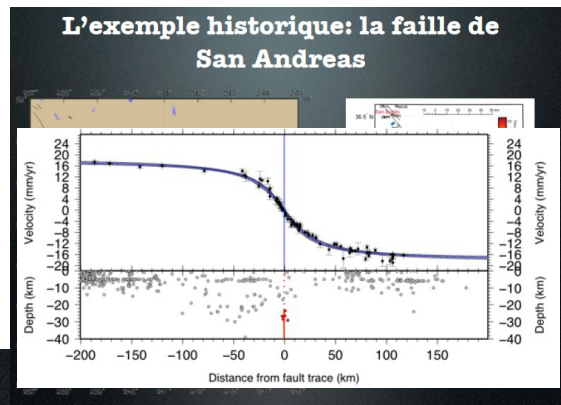
PROPOSAL OF
TWO ANALOG MODELS
OF EARTHQUAKES

Alain Le Métayer
octobre 2025
Normandie
FRANCE

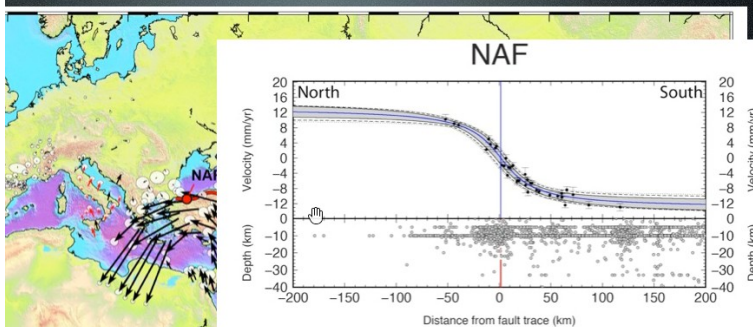
1. Take into account the measurements made in the field, the elastic deformation of the rocks at the level of a fault (chosen example: strike-slip fault)

déformation intersismique des failles décrochantes, implications sur la structure et la rhéologie de la lithosphère

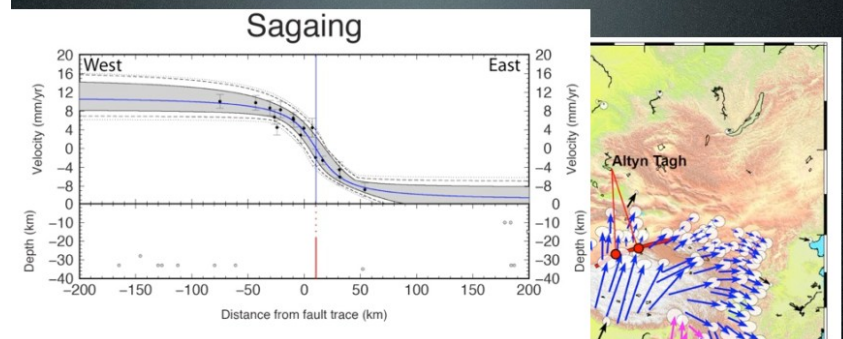
Philippe Vernant



La faille Nord Anatolienne



La faille de Sagaing



Quantifier les ruptures de surface



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DES GÉOSCIENCES

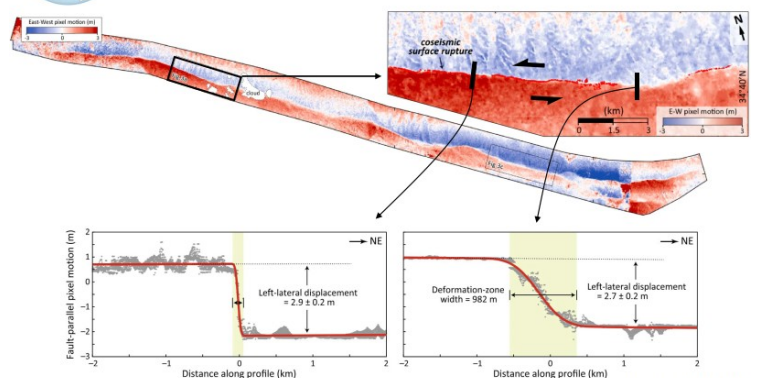
Maxime Henriquet
Géoazur, Université Côte d'Azur

GEO AZUR
Aix-Marseille université
Initiative d'excellence



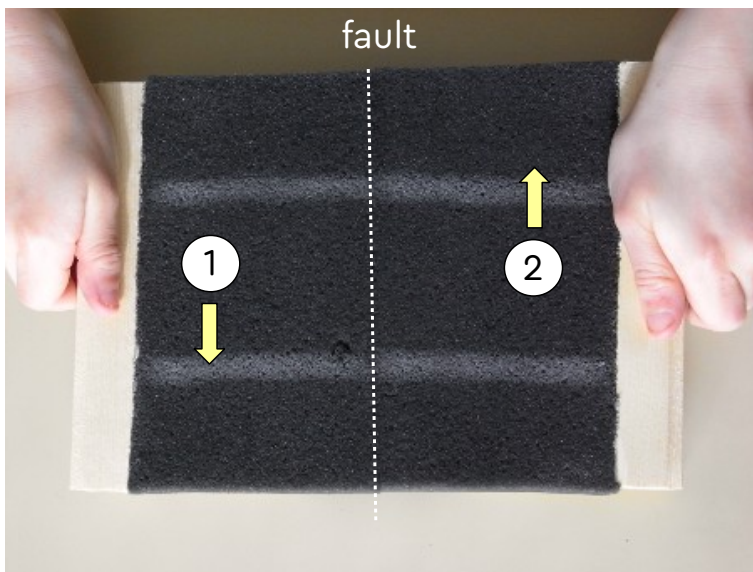
Séismes de Maduo
(Chine), 2021
 $M_w \approx 7.3$

Corrélation d'images optiques
Déplacements cosismiques



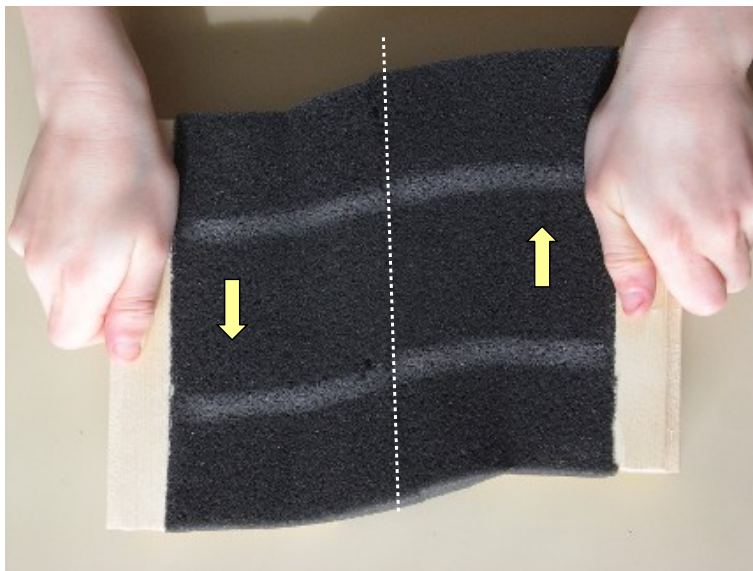
Li et al., 2022, 2023

2. A very simple and deliberately minimalist model of strike-slip fault showing the elastic deformation of the plates



Tectonic plates 1 and 2 are moving relative to each other but they are **blocked at the level of a fault due to the presence of asperities**.

↕↕ sense of movement of the plates in relation to each other

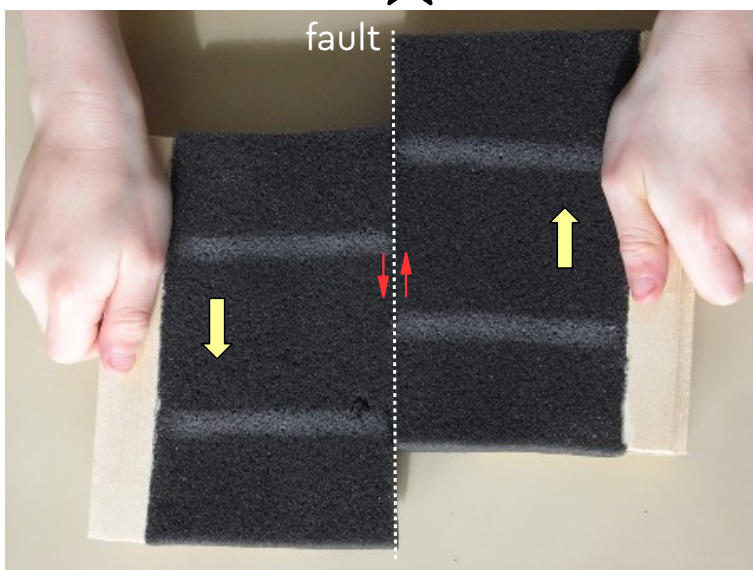


The plates continue their movement and deform. It is an **elastic deformation that accumulates energy**.

When the pressure becomes too strong, the rocks break at the seismic focus level.

★ earthquake

The accumulated elastic energy is suddenly released in the form of seismic waves: it's the earthquake!

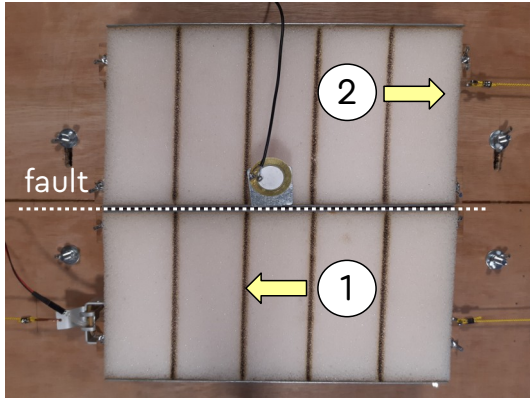


After the earthquake, **the rocks are shifted**.

The tectonic plates continue their movement... until the next earthquake.

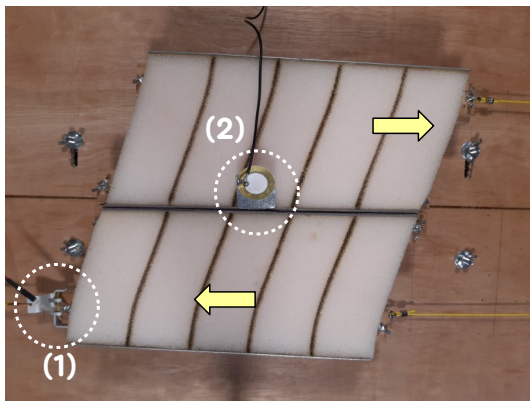
↕↕ sense of the rocks shift

3. A strike-slip fault model that allows observing elastic deformation and recording stresses and mechanical waves.

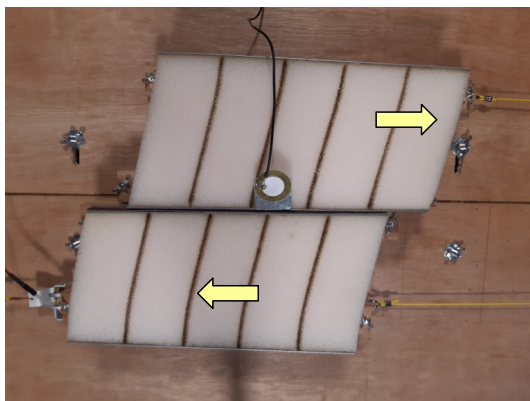


Tectonic plates 1 and 2 are moving relative to each other but they are **blocked at the level of a fault due to the presence of asperities**.

↕ sense of movement of the plates in relation to each other

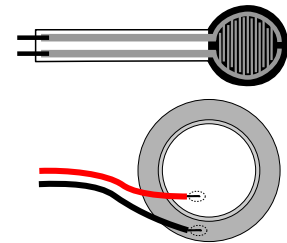


★ earthquake



The plates continue their movement and deform. It is an **elastic deformation that accumulates energy**.

- (1) FSR force sensor
- (2) piezoelectric sensor



When the pressure becomes too strong, the rocks break at the seismic focus level.

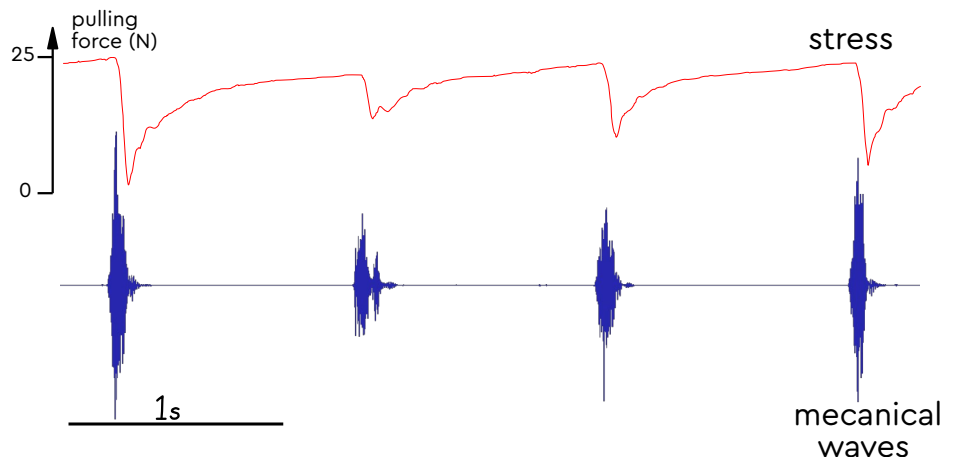
The accumulated elastic energy is suddenly released in the form of seismic waves: it's the earthquake!

After the earthquake, the rocks are shifted but are still deformed; not all the accumulated energy was released in a single earthquake.

The tectonic plates continue their movement... until the next earthquake.

Recording of four "foam earthquakes".
With each break in the asperities* of the friction band placed on either side of the "fault", the sliding is accompanied by a drop in stress and the production of mechanical waves.

* the grains of the friction band are broken, we can collect dust from them.



A webcam allows to capture the dynamic differential of the phenomena of deformation and sliding. The microphone completes the piezoelectric sensor's mechanical wave recording.

An analog model is ostensive-inferential communication.

Within the frame of Relevance Theory (Sperber & Wilson, 1986), Communication is not solely verbal; it is a general cognitive process, ostensive-inferential, in which a sender manifests their intention to communicate so that the receiver can infer the informational content from the relevant clues provided. When an analog model is used to represent a natural phenomenon such as earthquakes, the designer must ostensively indicate their intention to communicate with the observer. But, for this communication to reach an optimal level of relevance, the model must minimize the cognitive cost of interpretation. This implies that the structure of the model closely respects that of the real it aims to represent. By maintaining a structural homology between the model and the real, the designer facilitates the inferential process of the observer, who can thus more easily recognize the model/real correspondences. Thus, the structural fidelity of the analog model constitutes an essential condition for relevance in scientific or educational communication.

Analog models that do not respect structural homology will require greater cognitive effort and mechanically decrease the relevance of the model. If there is no sufficiently obvious correspondence between the elements of the model and the real elements (e.g. two horizontal plates) nor relational correspondence (e.g. two plates separated by a fault and having a contact plane that corresponds to the fault plane), the model will necessarily require the construction of an abstract intermediate model that must serve as a link between the concrete model and the real.

The construction of this abstract model poses two problems:

1. The choice of elements and relationships of the non-homologous model to be retained or rejected for the construction of the abstract model.
2. The consequence of the first point is a high risk of error leading to a distorted representation of the dynamic aspects (the processes) and static (the topology) of the real phenomenon.