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Imbricated fluid diffusion and aseismic slip in a Corinth Gulf swarm (Greece)

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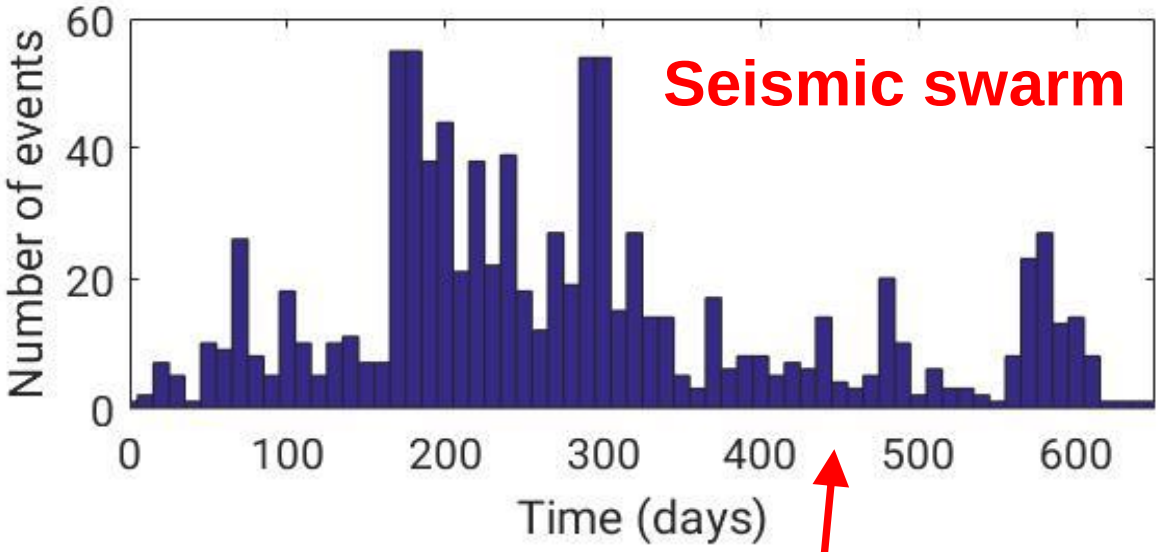
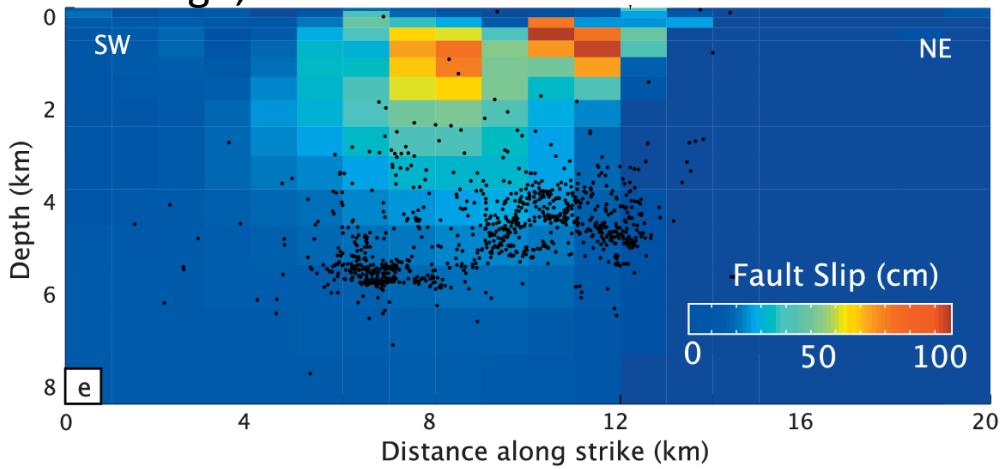
Driving processes of seismic swarms?



Slow-slip?

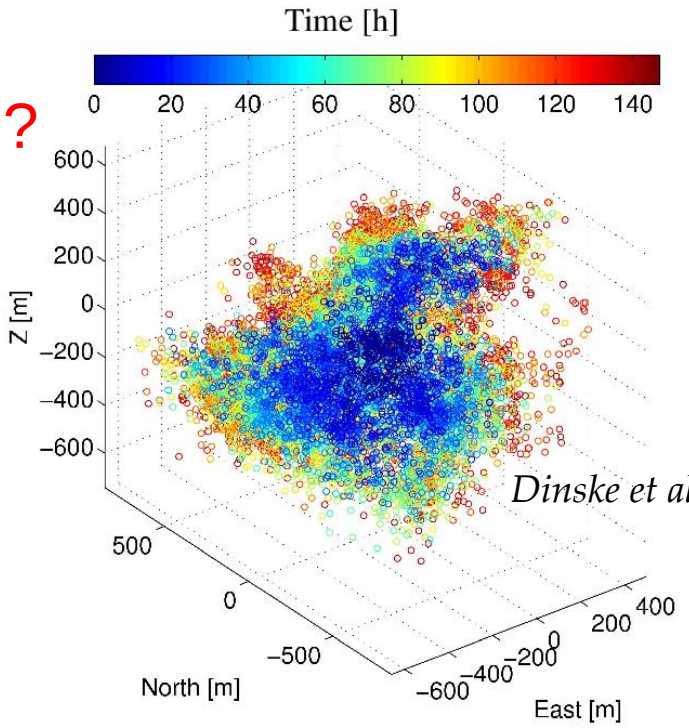
Salton trough, 2005



Lohman and McGuire, 2007

Fluid diffusion?

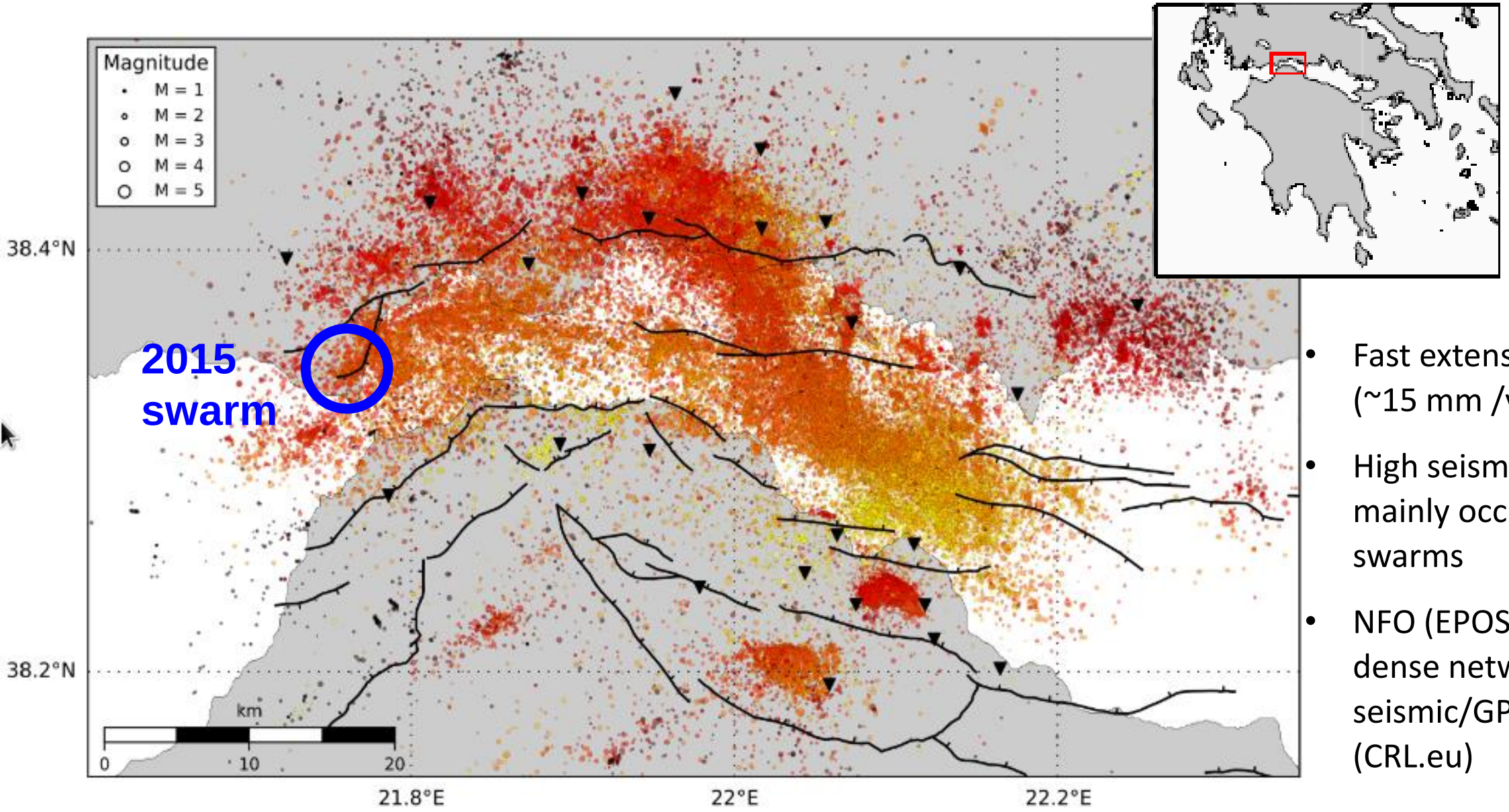
Soultz-sous-forêt,
2010 EGS injection , France



Dinske et al., 2011

Can we reconcile fluid diffusion and aseismic slip in the driving processes of seismic swarms?

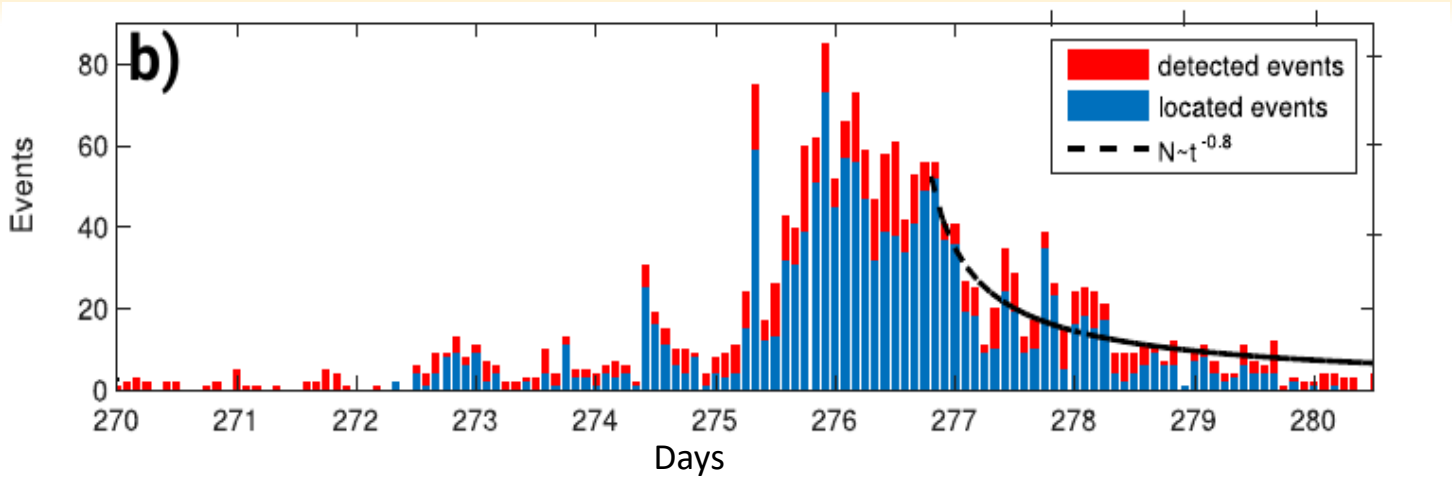
The Corinth Gulf and the CRL network



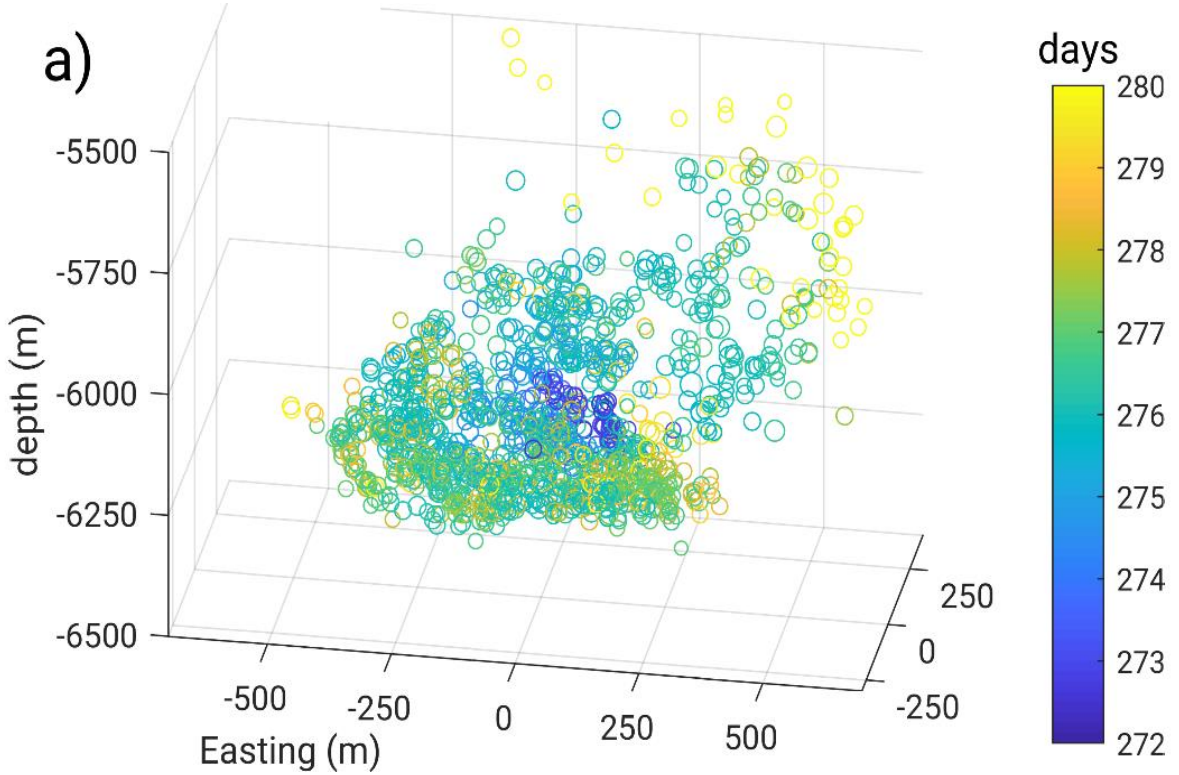
- Fast extensional rift (~15 mm /year)
- High seismicity rate, mainly occurring as swarms
- NFO (EPOS), with a dense network of seismic/GPS stations (CRL.eu)

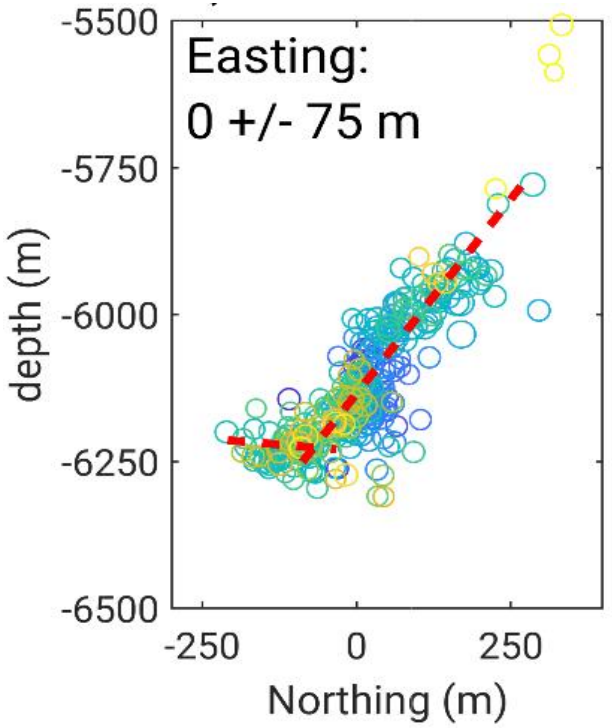
Duverger et al., 2018

A small swarm in the Corinth Gulf

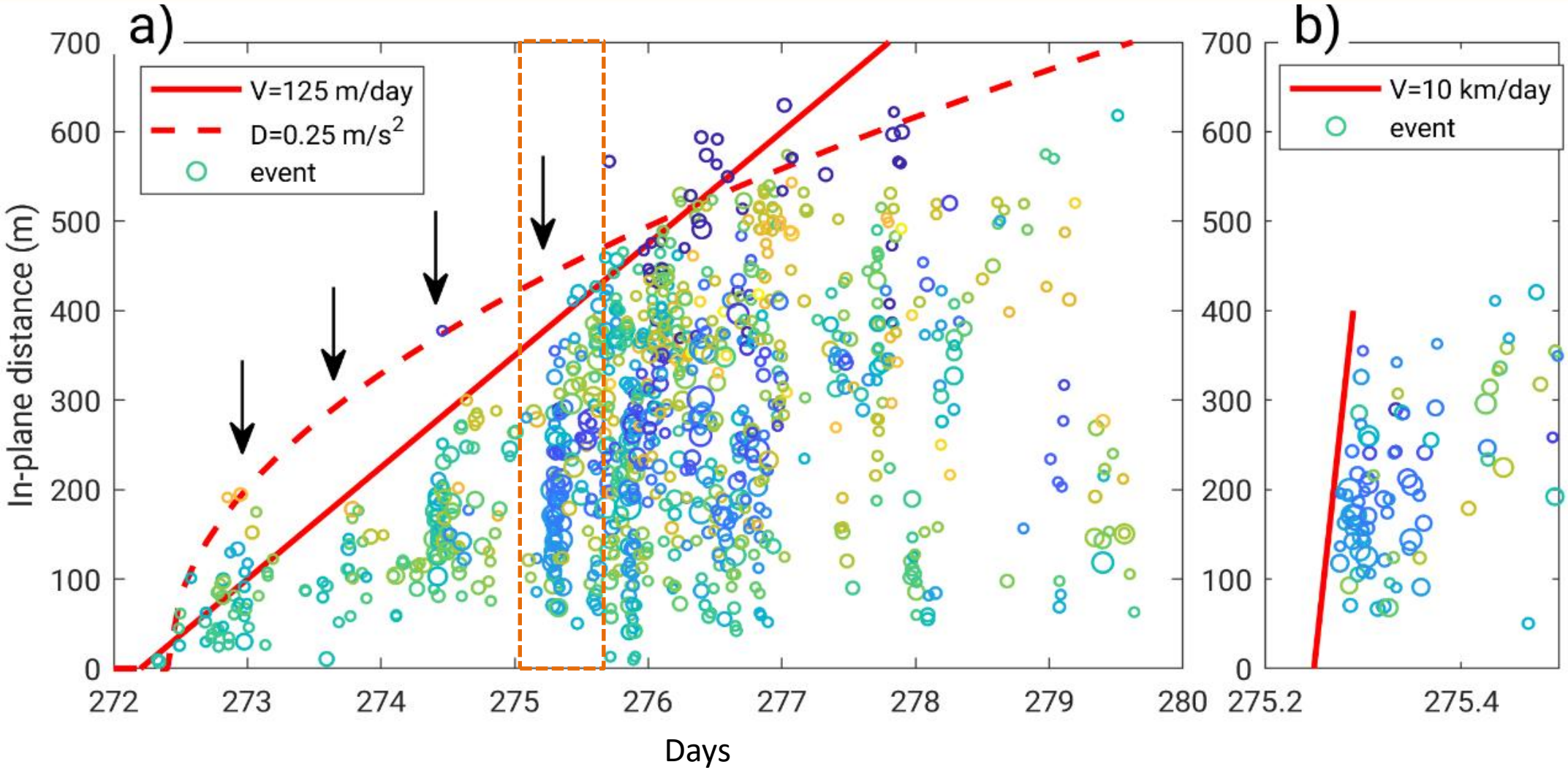


- ~ 2000 events
- a 10-days period
- Magnitude < 3
- A planar structure



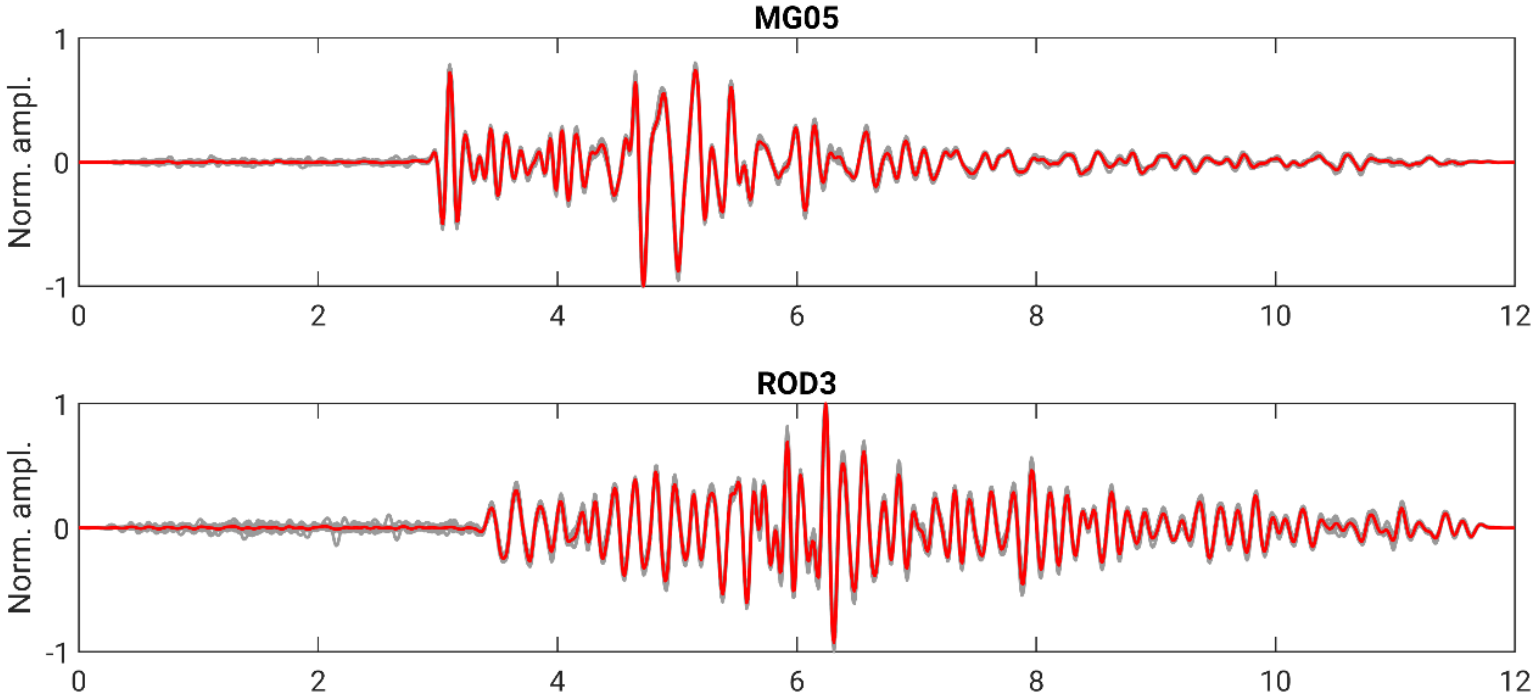


Two migration velocities



- Overall migration compatible with fluid diffusion
- Bursts of seismicity with fast velocity migration during slow-slip episodes

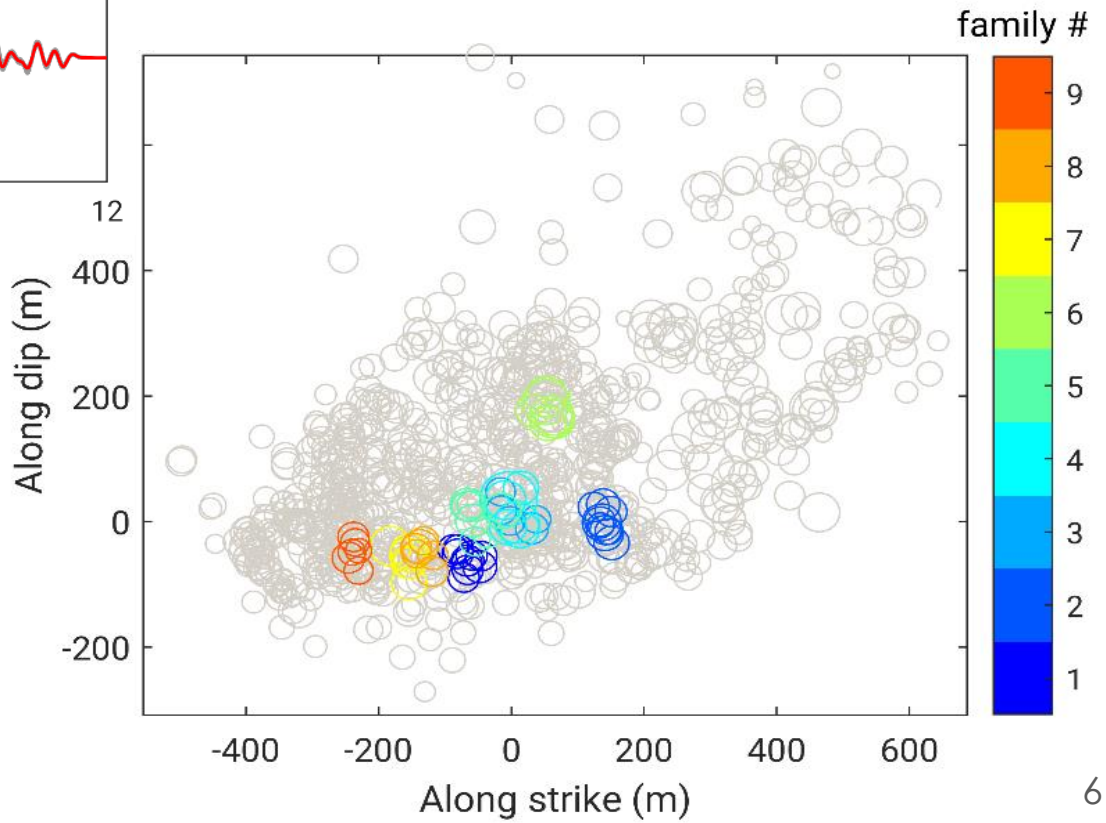
Repeating events



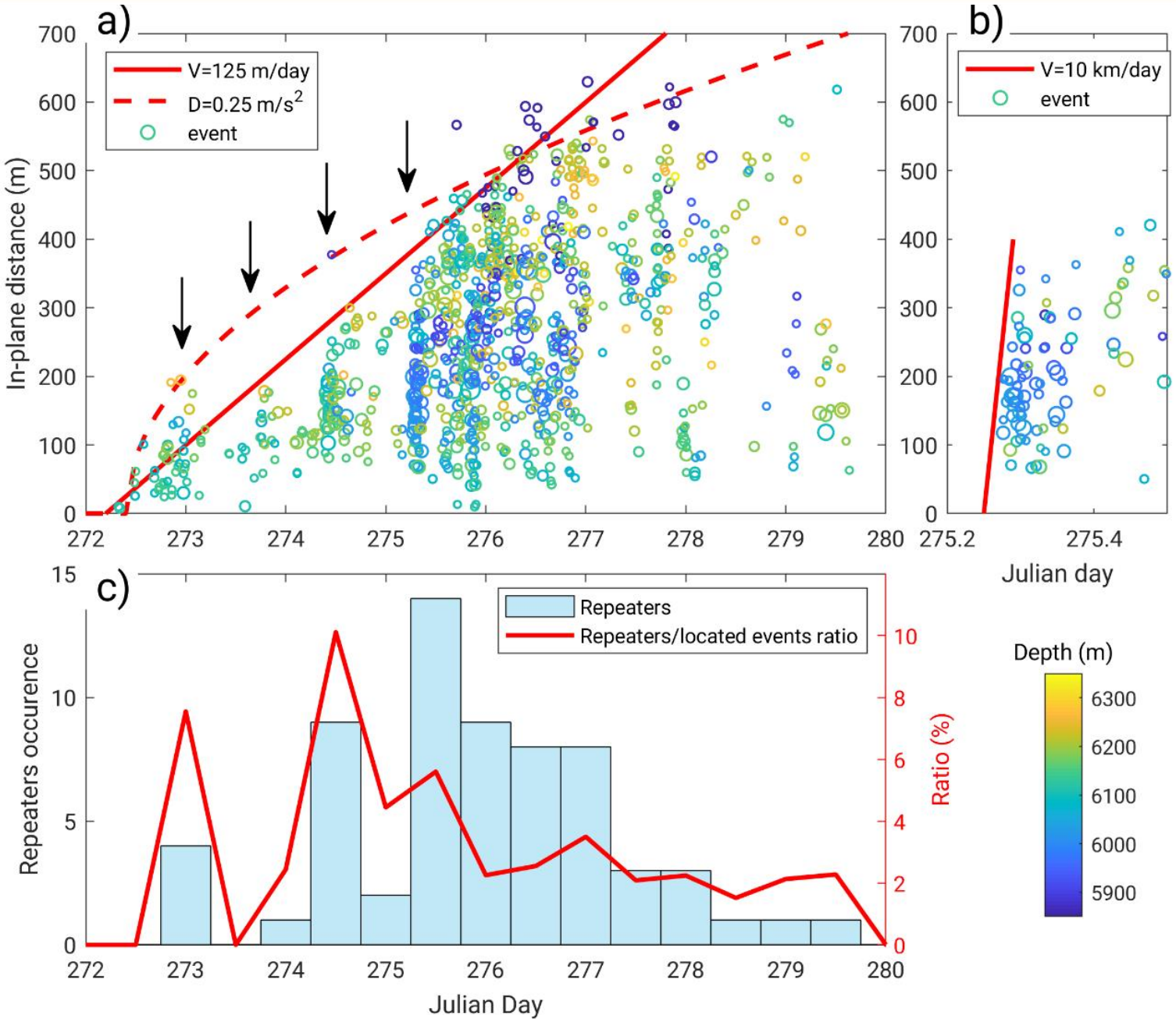
- **65 events (CC >0.95) in 9 families**
- Partial overlap of the source area

=> Repeating failure on particular asperites

=> Stress reloading by slow-slip?



Repeating events and migration



1) Overall migration

=> **fluid diffusion**

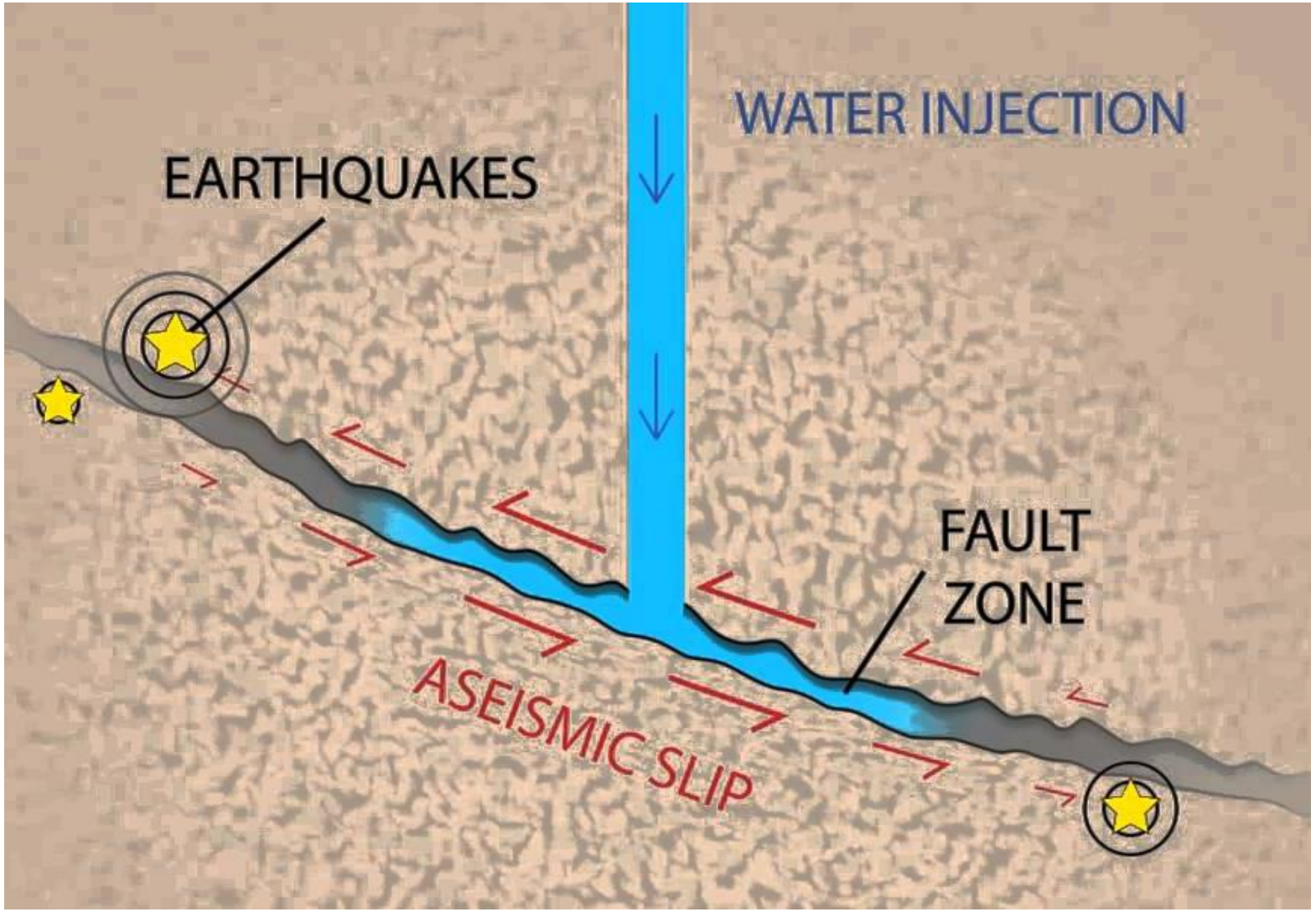
2) Bursts of seismicity with:

- Fast migration
- High ratio of repeating events

=> **slow-slip events**

De Barros et al., GRL, 2020

Spying on injection-induced seismicity results

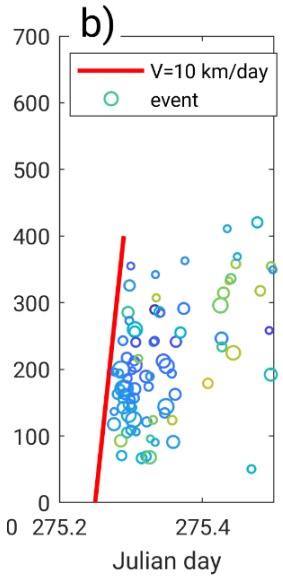


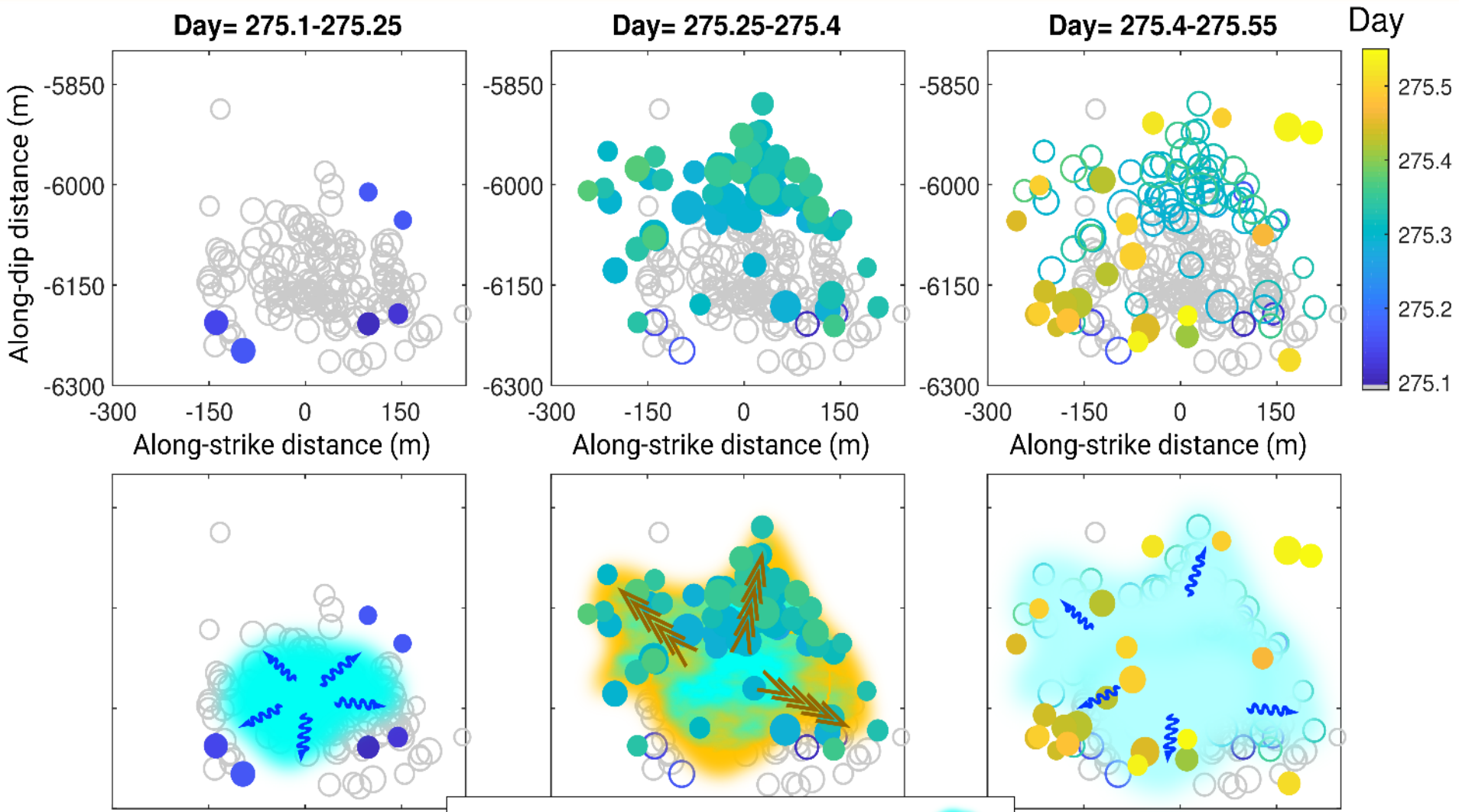
Fluid injection experiments (laboratory, decametric scale, reservoir and numerical modellings) show:

- fluid pressure dominantly induces aseismic slips
- Seismicity triggered by stress transfer from fluid-induced aseismic slips

(Guglielmi et al., 2015; De Barros et al., 2018; Cappa et al. 2019; Wynants-Morel et al., 2020)

Alternating phases of pressure build-up and aseismic slips





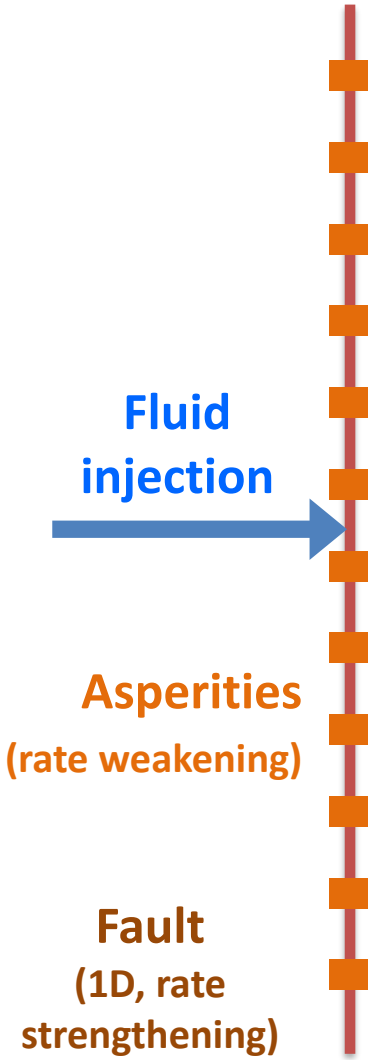
1- Pressure build-up (seismic quiescence)

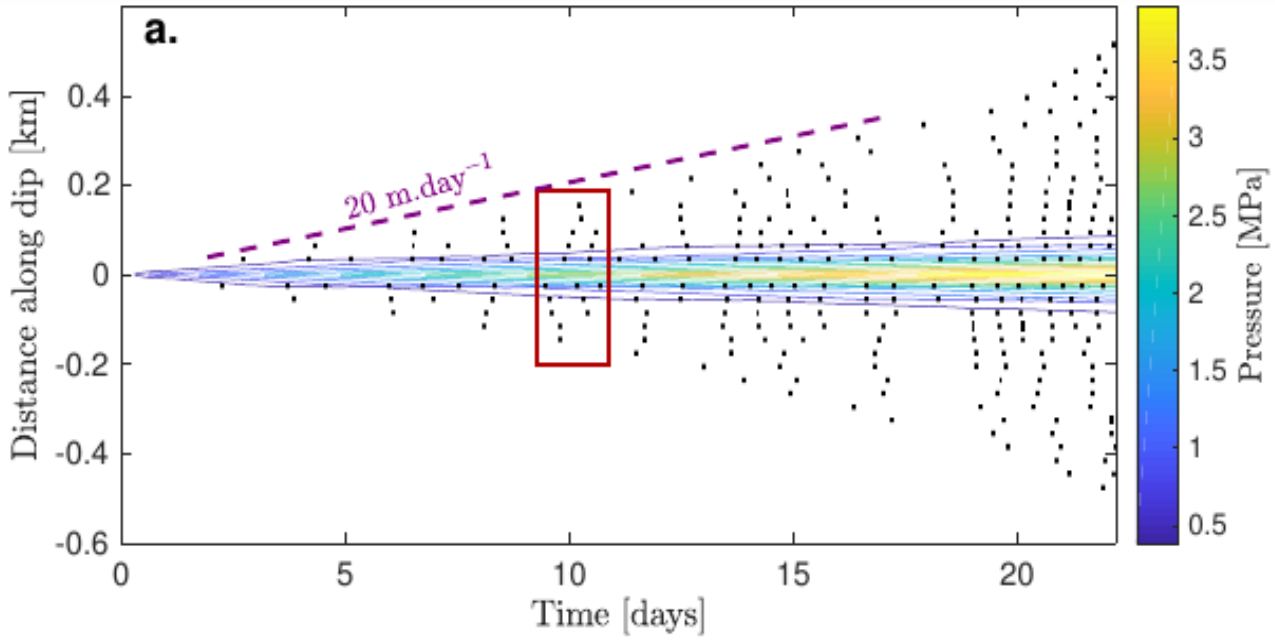
2- Slow slip (bursts of events)

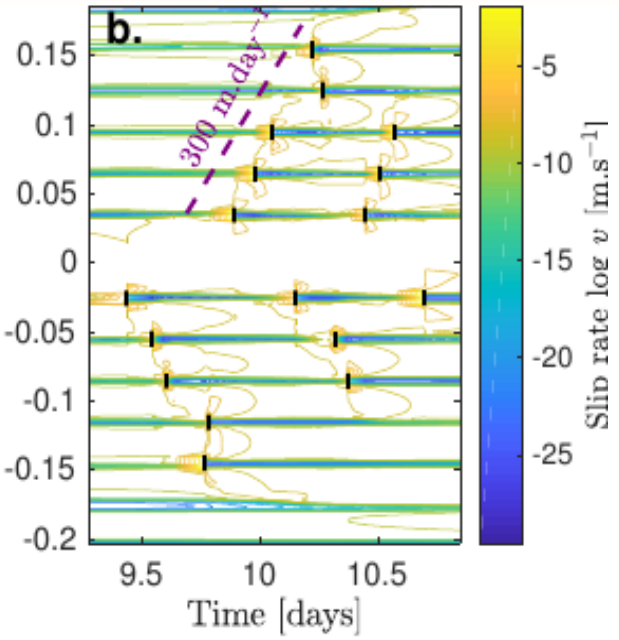
3- Pressure and stress balance

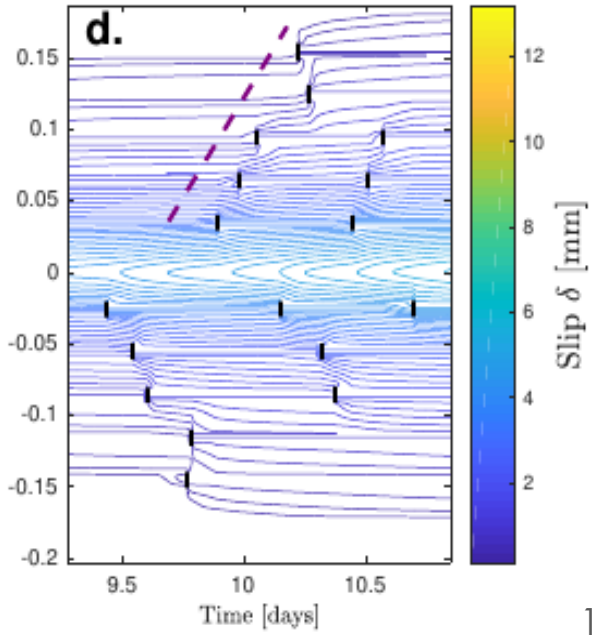
De Barros et al., GRL, 2020

Validation through numerical modellings





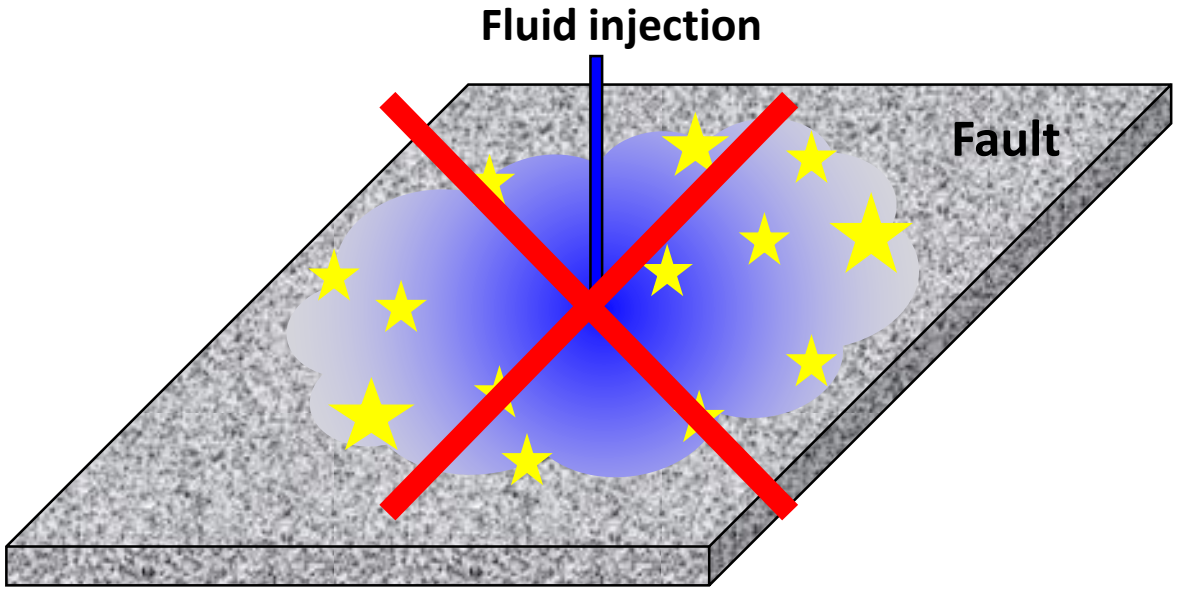




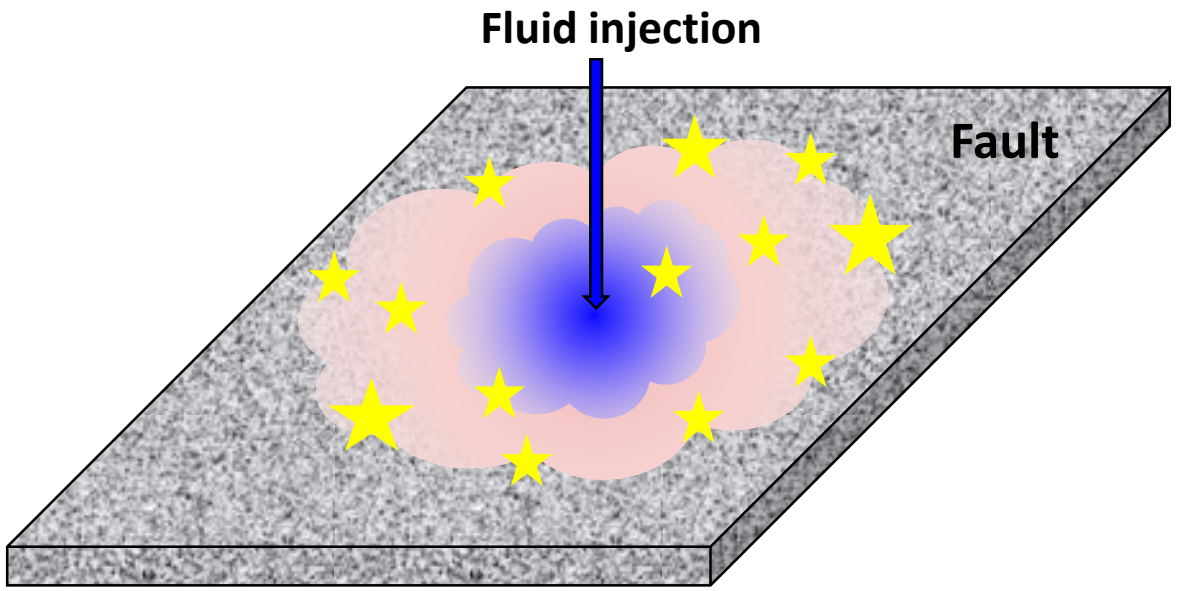
- Seismic front ≠ pressure front
- Global seismic migration consistent with fluid diffusion
- Seismicity as bursts, with fast migration
- Earthquake cascading through aseismic slip from one asperity to another

Dublanchet and De Barros, GRL, 2020

Fluid pressure



Aseismic slip



A seismic swarm driven by a fluid-induced aseismic slip

Danré et al., in prep

Thanks for your attention

For more details:

Geophysical Research Letters

RESEARCH LETTER
10.1029/2020GL087142

Imbricated Aseismic Slip and Fluid Diffusion Drive a Seismic Swarm in the Corinth Gulf, Greece

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Geophysical Research Letters

RESEARCH LETTER
10.1029/2020GL090025

Dual Seismic Migration Velocities in Seismic Swarms

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