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Seismic cycle of the intra-continental Petrinja fault (Croatia): from the 2020 Mw 6.4 earthquake to Quarternary deformations

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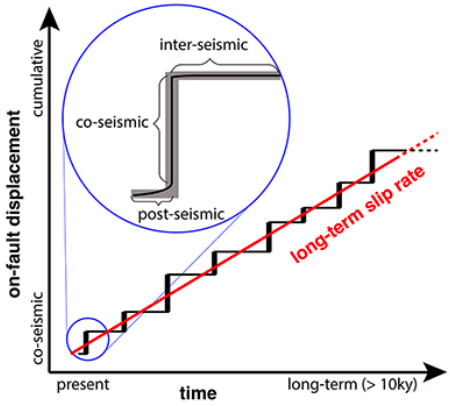
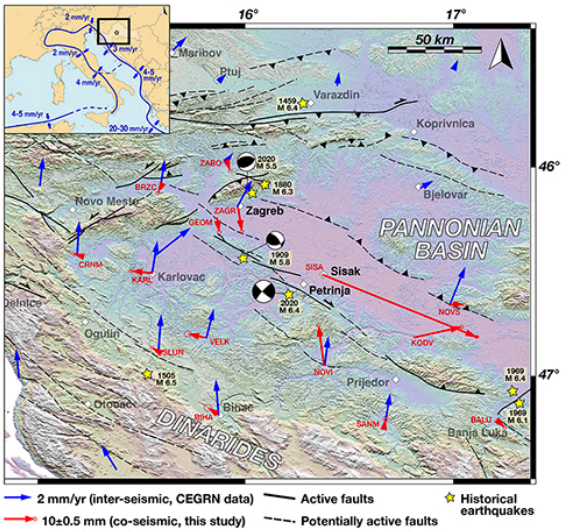
INTRODUCTION

Context: The **2020 Mw 6.4 Petrinja earthquake** activated a right-lateral **intra-continental fault**. Understanding the **seismic cycle** of such fault is critical for seismic hasard assessment, but it is usually limited by the **low occurrence of earthquakes**, **poor geodetic means** and **few long-term analysis** of the deformation in **slowly deforming regions**.



Questions:

- How are the **co-seismic and long-term** (> 10 ky) deformations distributed on the Petrinja fault?
- What is the **slip rate** of the fault at the scale of several thousand years?
- What does the co-seismic slip, surface ruptures and cumulative offsets say about the **maturity of the fault**?

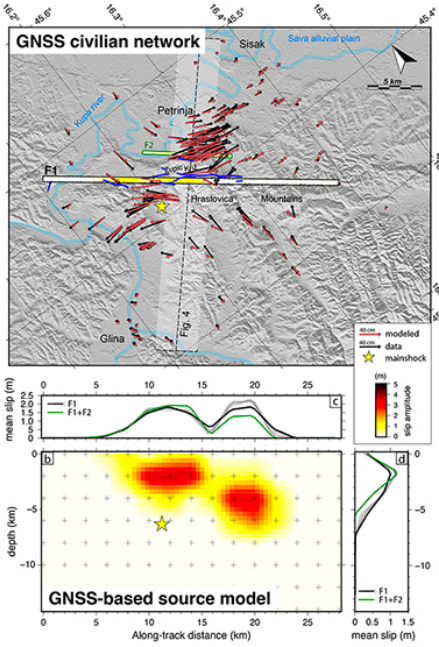


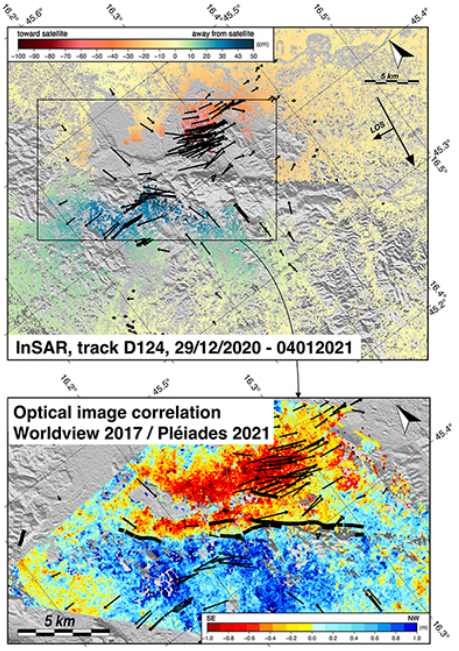
APPROACHES & RESULTS

Geodetic co-seismic displacement fields and source modeling

169 near-field GNSS civilian remeasurements slip inversion model with 1 or 2 faults

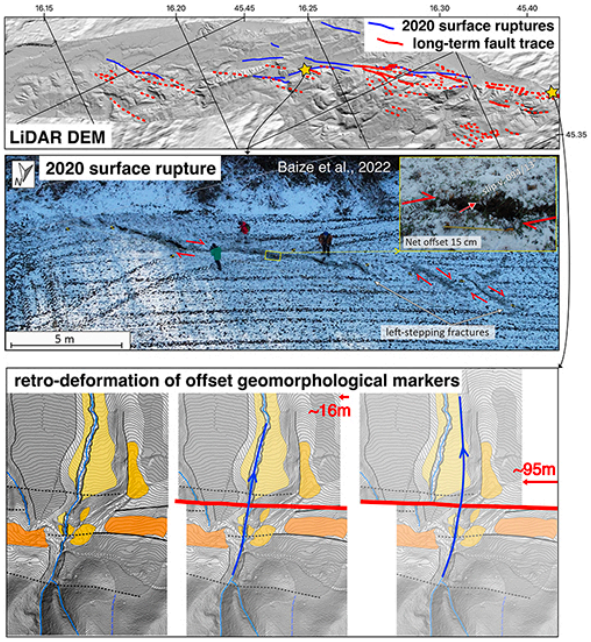
Co-seismic Sentinel-1 interferograms (2 tracks) Optical image correlation (Pléiades & Worldview)





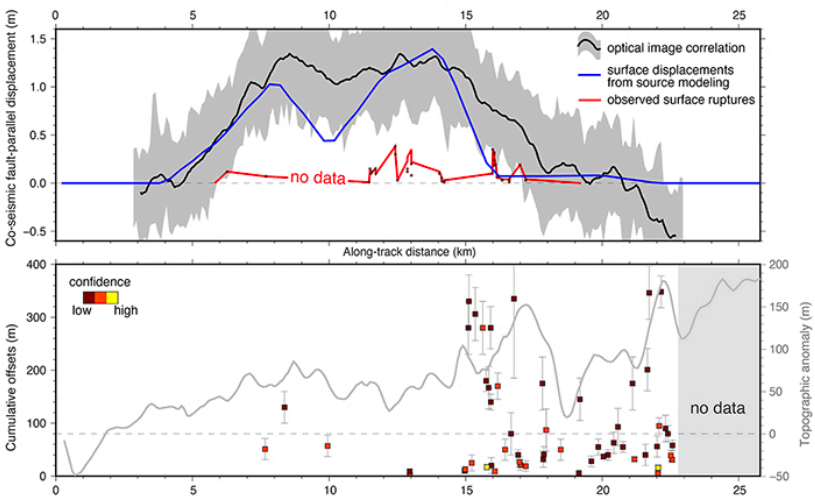
Offsets from topographic and field data

Geomorphology from high resolution DEMs (Pléiades, LiDAR)
Field measurements of 2020 surface ruptures



OUTCOMES

Comparison of short-term and long-term displacements



Discussion and conclusions:

* Dense **civilian benchmark remeasurements** can provide **very detailed near-field coseismic** displacement fields in populated areas.

* **Inversion** of near-field GNSS benchmarks indicates **2 slip patches** on the main fault and a significant slip on a **parallel secondary fault**.

* The **total co-seismic** right-lateral displacement (> 120 cm) from geodetic data (GNSS, InSAR and optical image correlation) is much **higher than the surface rupture measurements** (< 30 cm).

* **Long-term cumulative offsets** are mostly located to the **south** while the **2020 rupture** occurred to the **north**.

Perspectives:

> **Joint inversion** of the coseismic displacement fields (GNSS, InSAR and optical image correlation) will improve the slip inversion.

> **Quaternary dating** of offset geomorphological markers will constrain the **slip-rate** of the Petrinja fault.