Quantitative Analysis of Earthquake Swarms through Advanced Data Analysis Tools

(Proposer: Dr. Piero Poli)

Earthquake swarms, marked by unordered seismic sequences driven by transient forces, present a significant challenge to conventional seismic models. Conventional physical laws struggle to accurately describe the occurrence, duration, and moment release of swarms, emphasizing their complexity within the seismic cycle. Despite their importance in tectonically active regions, earthquake swarms are frequently overlooked in routine seismic hazard assessments. This project endeavors to conduct a thorough quantitative analysis of earthquake swarms, utilizing advanced seismological data analysis tools. The approach involves leveraging cuttingedge artificial intelligence and data mining techniques to extract novel observables from seismological and geodetic data collected from near-fault observatories. Subsequently, the derived observations will inform the modeling of episodes of aseismic deformation in both the Italian region and globally. This modeling aims to illuminate the intricate interplay between seismic and aseismic deformation within fault zones. The identification of repeating and near-repeating earthquakes from the newly generated catalogs serves as a crucial step in discerning the persistence of seismic sources. This identification acts as an analog for in situ strain meters, providing a precise estimation of slip budgets in seismogenic faults. The novel observables will be instrumental in the development of innovative stacking methods for parsing geodetic data. This approach will yield additional insights into aseismic deformation within faults. Finally, the project will delve into modeling the kinematic and source scaling properties of the studied swarms. This includes examining spatio-temporal migration, duration, and moment release. By advancing our understanding of earthquake swarm occurrences, this project aims to significantly contribute to the evolving field of seismic research. Ultimately, the insights gained will enhance our ability to assess seismic hazards, paving the way for improved earthquake preparedness and mitigation strategies.

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