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Best practices for using and reporting subsurface geological/geophysical data in defining and documenting seismogenic faults.

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Earthquakes of engineering significance (magnitude 5 and above) are generated by pre-existing, relatively mature geological faults. These faults generally span a length from a few to several tens or hundreds of kilometers and can break the entire Earth's crust.

Defining the three-dimensional configuration of such seismogenic faults is crucial for developing applications for earthquake hazard analyses at different spatial scales and, in turn, contributing robust information to promoting earthquake risk mitigation strategies.

The reconstruction of geological fault surfaces is a typical multidisciplinary study involving a large variety of data types and processing methods that, inevitably, imply various degrees of geometric simplifications depending on the available data. Among them, the most powerful, although expensive, approaches are the techniques developed for hydrocarbon exploration, namely seismic reflection (2D-3D) data combined with logs of drilled wells, which can illuminate the Earth's subsurface at several kilometers depth. The mining and oil and gas industries have historically collected a large amount of this data, which remained classified depending on the regulations of the country from which they obtained the license for exploration. As time passes, and with the waning of fossil fuel exploitation, the exploration licenses expire or are not renovated, and more of such data becomes available to amalgamate with data collected by research institutions or public/private ventures using public funding.

Despite the vast literature on and applications of hydrocarbon exploration data, no standard procedure exists for documenting the use of such data in characterizing seismogenic faults. In this respect, scientists face challenges posed by the intersection of industry data with public research outputs, with important societal implications and barriers to ensuring FAIRness. To this end, we devised a workflow detailing the best practices to follow in the various steps geologists undertake in using hydrocarbon exploration data, starting from the source of the raw/processed data (public vs confidential) and ending with the final geological fault model. The workflow output is then ready to be integrated with the information and data from other scientific disciplines (e.g., seismology, paleoseismology, tectonic geomorphology, geodesy, geomechanical modeling, earthquake statistics) to obtain the most reliable seismogenic fault model. As proof of concept, we will present

a simplified version of a software tool that guides the user in incorporating the workflow's various elements into a structured database of seismogenic faults.