Towards a comprehensive European fault database for induced seismic hazard research

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Seismogenic faults and fault systems in tectonically active regions are extensively studied as a source of seismic hazard and especially of high magnitude natural earthquakes. Global research has already resulted in several databases and models presenting location, characteristics and kinematic behavior of such faults (e.g. GEM Global Active Faults Database, SHARE European Database of Seismogenic Faults, USGS Quaternary faults database).

Faults that are inactive under present-day geological conditions are far more abundant, yet less-well documented. Nevertheless, these faults can potentially pose significant hazards under anthropogenic activities, particularly when the stress state of such faults is influenced by adjacent active fault systems (e.g. Northern Italy). Subsurface extraction and injection of fluids can either alter the in-situ stress state to a level exceeding the critical stress threshold (e.g. through pressure-induced compaction) or reduce the fault strength to a point where natural stresses can trigger fault movements (e.g. through the invasion of fluids into the fault zone). Well-known cases are reported among others in Basel – Switzerland (geothermal stimulation), Oklahoma – US (waste water injection) and Groningen – The Netherlands (conventional hydrocarbon extraction).

Here, we present the development of a pan-European fault database by the project GeoERA-HIKE. The database incorporates the locations, geometries, characteristics and scientific references of both active and inactive faults and fault systems and will be complementary to existing databases of seismogenic faults. The database information is derived from national mapping studies and local assessments by the European Geological Survey Organizations and includes, amongst others, surface outcrop observations, geophysical monitoring, boreholes and geological modelling studies.

The primary goal of the database is to support induced hazard studies with better access to
harmonized data and knowledge on fault characteristics and behavior. The correlation of fault systems across Europe with a generic semantic concepts framework provides better insight into the genetic links between active and inactive fault systems within the greater structural geological development of Europe. The integration of data from different geoscience disciplines will improve the understanding of in-situ characteristics and behavior. Ultimately, the database is intended to become a collaborative tool for future fault characterization and research by geoscience institutes.

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