ESHM20 source model versus strain rate map: comparison of moment rate estimates

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Most national and international seismic regulations require quantifying seismic hazard based on probabilistic seismic hazard assessment (PSHA) methods. The probabilities of exceeding ground-motion levels at sites of interest over a future time window are determined by combining a source model and a ground-motion model. This research work aims at understanding how the measurement of strain rates by geodesy can provide constraints on the source model.
Earthquake catalogs, merging instrumental and historical data, are usually used to establish earthquake recurrence models. Although these catalogs extend over several centuries, the observation time windows are often short with respect to the recurrence times of moderate-to-large events and in some regions the recurrence models can be weakly constrained.
Strain rates maps were calculated for Europe using a combined velocity field (Piña Valdes et al. 2021). These strain rates are compared to the source model of the new European seismic hazard model (ESHM20, Danciu et al. 2021). More precisely, the moment rates estimated from the earthquake recurrence models are compared to the geodetically-derived moment rates. The first results show that a correlation exists between the seismically and geodetically derived moment rates, but the regression coefficient is not one. In areas characterized by high activity, such as Betics or Apennines for example, the moment rates derived by both methods are comparable. In areas of lower activity, such as at the interior of plates, the error associated with geodetic measurements is of the same order of magnitude as the measured strain, and the relation between catalog-based and strain-based moment is not straightforward. In this work we explore the different uncertainties in both data sets to understand better how both observables are related, and to assess under what conditions geodetic observations could be used in PSHA studies.

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