How new fault data and models affect seismic hazard results?

Examples from southeast Spain

J.M. Gaspar-Escribano, M.B. Benito, A. Staller, S. Ruiz Barajas, L.E. Quirós

1 OBJECTIVE
Study the impact of different approaches to include fault data and models in a probabilistic seismic hazard assessment.

2 CONTEXT
- Area of application: Murcia, one of the most active areas in Spain
- Low-to-moderate seismic activity
- Availability of fault slip rates from paleoseismic data and from geodetic data (GPS-based measurements)

3 FAULT DATA
- Area-source model of the recent hazard map of Spain
- Paleoseismic data and fault geometries extracted from QAFI database
- Slip rates derived from GPS data

4 SOURCE MODELS
Model 1 Distribution of seismicity based on magnitude (m0)
- Faults sources for big events (m0) only and characteristic earthquake model (CE)
- Area sources for small events (m0) only and modified Gutenberg-Richter (mod-GR) recurrence model

Model 2 Distribution of seismicity based on moment rate (M0)
- Distribution of seismic potential assigned to faults and area-sources within the magnitude interval [m0-m0] where the catalog is complete
- Mod-GR recurrence model for both faults and area-sources

5 PREVIOUS STUDIES
- The new hazard maps of Spain, based on an area-source model, and the updated hazard map for the risk plan of the study area (including fault sources as in Model 2 and paleoseismic data) provide expected PGA values of 0.10 - 0.24 g (for a return period of 475 yrs on rock conditions)

6 WORK FLOW
1. Select input choices
2. Compose models
3. Compute seismic hazard
4. Make sensitivity analysis
5. Compare with previous studies

7 RESULTS AND SENSITIVITY ANALYSES
7.a. Model 1. Sensitivity to slip rate values
- Increase factor on expected PGA

7.b. Model 2. Sensitivity to slip rate values
- Increase factor on expected PGA

7.c. Sensitivity to source models
- High COV values along fault traces (Fig. 7) imply a strong variability related to slip rate values.
- High COV values along fault traces (Fig. 8) show a strong variability related source model.
- Both sources of variability are comparable (Fig. 9)

8 COMPARISON WITH PREVIOUS STUDIES
- Increase by a factor up to 1.8 in relation to recent work

9 CONCLUSIONS
- Geodetically derived slip rates yield much larger PGA values than paleoseismic slip rates.
- Model 2 (mod-GR to fault sources) leads to much higher expected PGA values
- Expected PGA values from recent studies are exceeded by a factor of up to 1.8